

Ecologically Significant Wetlands in the Missouri Headwaters:

**Jefferson, Lower Madison, Lower Gallatin,
and Upper Red Rock River Watersheds**

Prepared for:

Montana Department of Environmental Quality

By:

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Montana Natural Heritage Program
Natural Resource Information System
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SUMMARY

The Montana Natural Heritage Program, in partnership with the Montana Department of Environmental Quality, has completed an inventory of ecologically significant and restorable wetlands in the watersheds of the Missouri River headwaters in southwest Montana. This project identified high quality wetlands in the study area and evaluated their diversity and integrity. Building on previous watershed inventories, this work creates a consistent and comprehensive source of wetland information that can form the basis for effective prioritization of wetland protection and restoration efforts.

This inventory targeted wetlands with intact hydrological functions, representative native plant communities, outstanding wildlife values, and/or rare plant and animal species. Important sources for locating significant wetlands were local expert opinion and aerial photographs. We used standard Heritage Program methodologies to inventory wetlands and to assess site condition, catalog community types, and document rare plant and animal occurrences. Five criteria were used to evaluate each site's ecological significance: (1) condition, which includes degree of hydrologic or geomorphic alteration, quality of native plant communities, and presence of exotic species, (2) landscape context, which includes condition of uplands and hydrologic connectivity between wetland and uplands, (3) diversity, which includes the number of plant communities, structural vegetation types, and hydrologic classes, (4) rarity, which includes the number and

condition of rare plants, animals, or communities, and (5) size of wetland. We then placed sites into one of four categories, ranging from highest quality (A-ranked) to poorest quality (D-ranked).

Twenty-one ecologically significant wetlands were inventoried for this study. Of these sites, four rated as A-ranked wetlands, twelve as B-ranked wetlands, and five as C-ranked wetlands. A-ranked sites were relatively undisturbed to pristine. In general, their natural hydrologic regimes were intact, they supported high quality examples of native plant communities, and they had no or only minor weed populations. The uplands surrounding these sites were largely undisturbed, with minimal human alterations. These wetlands included montane peatlands and two large wetland complexes in the Red Rock Lakes National Wildlife Refuge. In contrast, B-ranked sites had been affected by both on- and off-site human disturbances, although many sites still maintained high functional capacity and supported high quality plant communities. This category included riverine and beaver-influenced wetlands, sloughs, a small montane peatland, and a large groundwater-discharge wetland, Piedmont Swamp. The remaining sites were rated as C-ranked wetlands. These wetlands have been functionally impaired through hydrologic or geomorphic alterations or through land use disturbances in the wetlands or adjacent uplands, and exotic species were widespread at a few sites. These sites included beaver-influenced riverine wetlands and depressional wetlands in the Centennial Valley.

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INTRODUCTION

Historically, wetlands have been considered unproductive lands with little value to society (Mitsch and Gosselink 1993). Consequently, wetlands have long been drained, filled, or otherwise manipulated to produce goods and services valued by society. This has resulted in significant wetland destruction and degradation in the United States. Dahl (1990) estimated that over half of the wetland acres in the conterminous United States have been lost since 1780, and that approximately 25% of Montana's wetland acres have been lost in the same period.

In the last 20 years, as awareness of the cumulative loss and damage to wetlands in the United States has grown, so too has society's appreciation of the ecological importance and economic benefits of wetlands. This recognition has expanded opportunities to prevent wetland loss and restore the condition of remaining wetlands. In Montana, there are numerous regulatory and incentive-based programs at the private, state, and federal level dedicated to wetland conservation (see Kyle (1998) for an overview of these programs). Wetland inventories, by identifying and assessing the condition of biologically significant wetlands, can improve the effectiveness of these programs and are an important first step in wetland conservation.

In 1998 the Montana Natural Heritage Program, in partnership with the Montana Department of Environmental Quality, began to systematically evaluate the diversity, integrity, and significance of Montana wetlands through watershed inventories. The goal of these inventories is to produce a consistent and comprehensive source of wetland information to help ensure that protection, restoration, and mitigation efforts target the full range of wetland diversity, including those wetlands that are outstanding, irreplaceable, or which contribute most to watershed integrity. It provides local landowners, county planners, land trusts, conservation districts, government agencies, and others access to reliable information on the diversity of wetland types as well as the location

and relative significance of specific wetland sites within target watersheds. This creates a basis for effectively prioritizing wetland protection and restoration efforts.

The initial Heritage Program inventories were conducted in the Flathead River watershed and are summarized in Greenlee (1999) and Cooper et al. (2000). Jones (2001) extended this effort to selected watersheds in the upper Yellowstone River basin. In addition to work accomplished in partnership with Montana DEQ, the Heritage Program has assessed wetland resources in other areas of the state, including the Thompson and Fisher River watersheds (Greenlee and Jones 2000, Jones and Hendricks 2002), the Kootenai National Forest (Jones 2003a), the lower Milk and Marias Rivers (Jones 2003b), and the Whitewater River watershed (Crowe and Kudray 2003). This current project, which inventoried wetlands in the headwaters of the Missouri River, builds on this previous work. Taken together, these inventories document ecologically significant wetlands in these important watersheds and contribute to our understanding of wetlands and their associated biological diversity in Montana. Figure 1 displays the status of Heritage wetland inventories conducted to date in the state.

Heritage inventories use standard methods both to identify ecologically significant wetlands at a watershed scale and to prioritize their importance for wetland conservation. This approach considers biological composition and condition as well as the functional integrity of wetland sites with respect to hydrology and landscape setting. The conservation significance of each wetland is evaluated based on standardized criteria developed for the state (Appendix C).

The wetland sites examined in this inventory fall within the wetland definition used by Cowardin et al. (1979), and all had at least one of the following attributes: hydrophytic vegetation, hydric soils, and/or wetland hydrology. This definition includes riparian areas, wet meadows, and vernal pools. Wetland terminology in this report follows definitions presented in Chadde et al. (1998) and Keddy (2000).

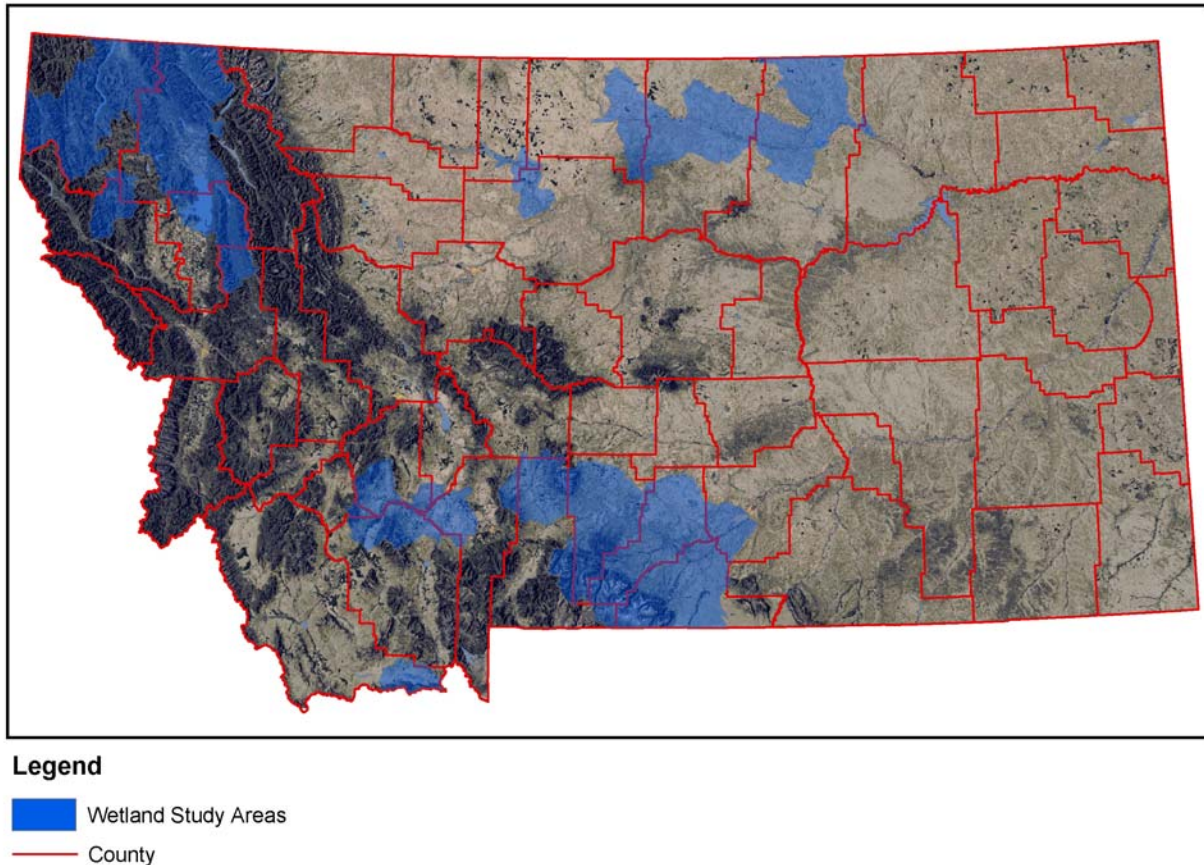


Figure 1. Map of watersheds surveyed by the Montana Natural Heritage Program for high quality wetlands.

Wetlands can be divided into several different categories depending on the amount and type of water they receive, whether herbaceous or woody vegetation is dominant, and whether the substrate is organic or mineral. **Swamps** are temporarily to seasonally flooded wetlands that are dominated by woody vegetation that is rooted in hydric soils, but not in peat or muck (organic soils composed of partially or wholly decomposed plant matter). **Riparian forests**, such as cottonwood gallery forests, receive less water than swamps and are usually temporarily or less frequently flooded. **Marshes** are seasonally to permanently flooded wetlands dominated by emergent herbaceous vegetation. Although marshes form on mineral soil, some peat accumulation can occur because of the tremendous productivity of marsh vegetation. In contrast, **peatlands** are wetlands with saturated substrates that have accumulated a layer of peat at least 30 cm deep in the upper soil horizon

(Chadde et al. 1998). Peatlands in Montana are either **fens**, dominated by herbaceous species, or **carrs**, dominated by shrubs. The water source for fens and carrs is groundwater that has been in contact with mineral soil (and thus may be high in nutrients), as opposed to **bogs**, whose water source is precipitation and therefore very nutrient poor. True bogs do not occur in Montana, although some fens are **mixed mires** that support bog-like microsites, such as raised mounds dominated by *Sphagnum* mosses. **Wet meadows** are dominated by herbaceous plant communities that are temporarily to seasonally flooded and have limited peat development because they usually dry down for part of the growing season. Wet meadows are often exceptionally species rich. The terms **slope**, **riverine**, **depressional**, and **lacustrine fringe** wetlands are all used as defined by Smith et al. (1995).

STUDY AREA

Physical Setting

The study area encompasses the headwaters of the Missouri River in southwest Montana (Figure 2). This area is located in Beaverhead, Madison, Gallatin, and Jefferson Counties, and includes the following watersheds, as defined by U.S. Geological Survey hydrologic unit codes (HUCs): the Jefferson River (4th-level HUC 10020005), the Madison River below Beartrap Canyon (5th-level HUC 10020007170), the Gallatin River below its confluence with the East Fork Gallatin River (5th-level HUC 10020008120), and the portion of the Red Rock River in the upper Centennial Valley (5th-level HUC 10020001010).

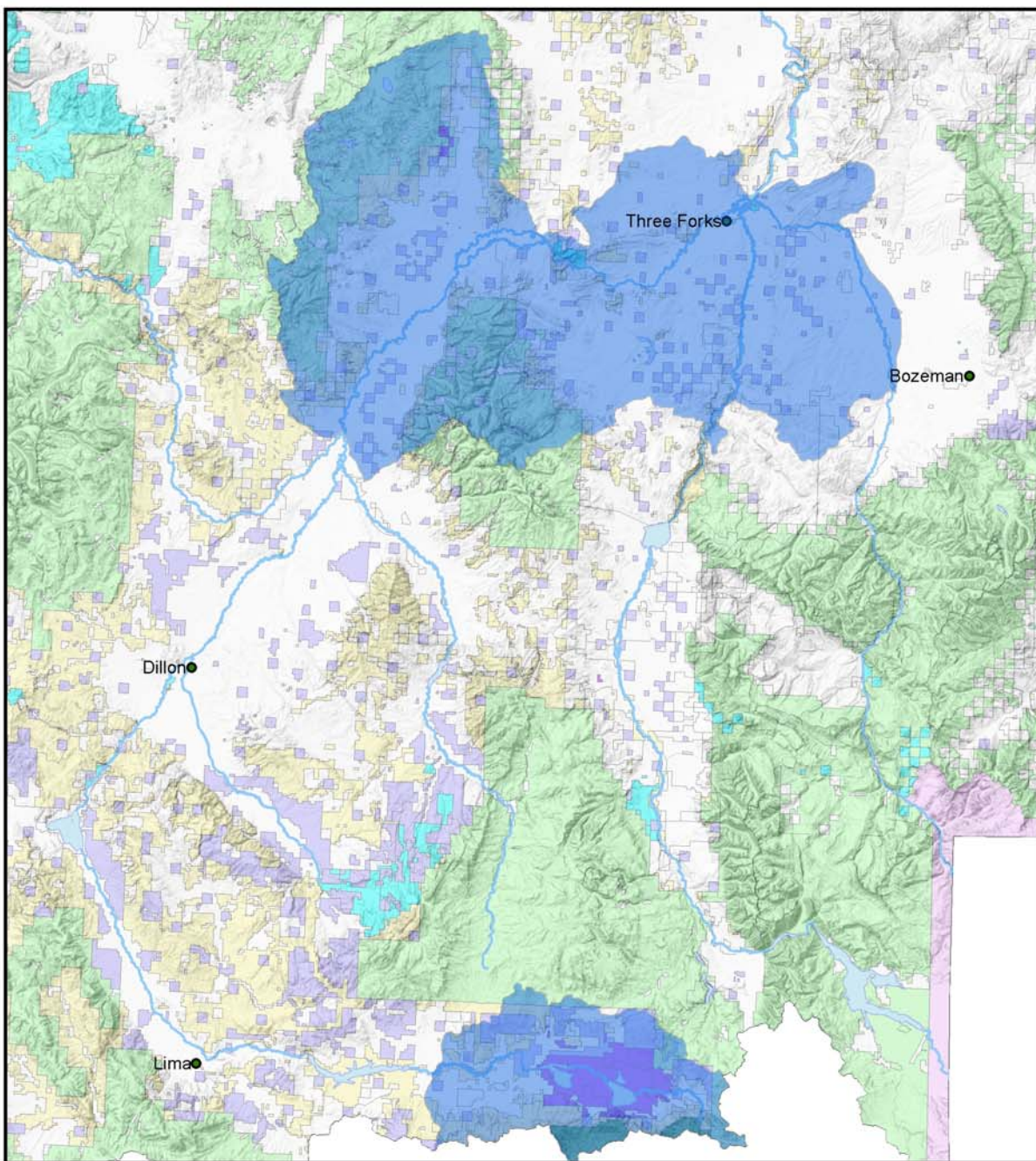
The region lies within the Northern Rocky Mountain and Montana Valley and Foothill Prairies ecoregions (Woods et al. 1999), and is characterized by broad intermontane valleys, isolated mountain ranges in the south and portions of the Boulder batholith in the north (Nesser et al. 1997). The major river valleys of the Jefferson and Gallatin Rivers are mantled in Quaternary alluvium that overlay 6,000 to 7,000 feet of older Quaternary and Tertiary deposits (Kendy and Tresch 1996). The Centennial Valley is of similar thickness with a mantle of Quaternary alluvium, reworked glacial lakebed deposits, and alluvial fans (Kendy and Tresch 1996, Lonn et al. 2000, O'Neill and Christiansen 2002). Both the Jefferson and Centennial Valleys are the product of Cenozoic extensional faulting. In fact, the fault along the southern margin of the Centennial Valley is one of the major active faults in Montana (Sonderregger et al. 1982). The geologic substrate underlying the mountainous portions of the study area include Tertiary Age granitic intrusions of the Boulder batholith north and west of the Jefferson River, Proterozoic quartzite and argillite in the Highland Mountains, and Precambrian gneiss and Tertiary granites in the Tobacco Root Mountains (Ruppel et al. 1993, Tuck et al. 1996).

The climate in the study area is semi-arid and continental. In the valley bottoms, mean temperatures range from 12.9°F in January to 58.9°F in July at Lakeview in the Centennial Valley and from 22.5°F in January to 64.4°F in July at Twin Bridges in the Beaverhead Valley; mean annual precipitation at these stations is 19.5 inches and 9.9 inches, respectively (Western Regional Climate Center 2004). Elevations of study area wetlands range from 4,000 to 6,700 feet in the valley bottoms to 8,500 feet for montane and subalpine wetlands.

Vegetation and Ecological Processes

Montane portions of the study area are largely dominated by coniferous forest. The composition of these forests varies with elevation. Subalpine forests of Whitebark Pine (*Pinus albicaulis*), Subalpine Fir (*Abies lasiocarpa*), Engelmann Spruce (*Picea engelmannii*), and Lodgepole Pine (*Pinus contorta*) are found at higher elevations. Middle and lower elevations are typically dominated by Douglas-Fir (*Pseudotsuga menziesii*) and Lodgepole Pine, whereas Ponderosa Pine (*Pinus ponderosa*) becomes dominant at the lower treeline. Limber Pine (*Pinus flexilis*) and Rocky Mountain Juniper (*Juniperus scopulorum*) are locally dominant on calcareous substrate. Small to medium-sized stands of Quaking Aspen (*Populus tremuloides*) may occur where adequate soil moisture is available, often forming at the base of toeslopes or on concave slopes.

Below treeline, vegetation is dominated by grass and shrublands. Shrublands are largely dominated by sagebrush, primarily Mountain Big Sagebrush (*Artemisia tridentata* ssp. *vaseyana*), although stands of Basin Big Sagebrush (*Artemisia tridentata* ssp. *tridentata*), Wyoming Big Sagebrush (*Artemisia tridentata* ssp. *wyomingensis*), and Threetip Sagebrush (*Artemisia tripartita*) are locally dominant. Stands of Greasewood (*Sarcobatus vermiculatus*) may occur in saline or alkaline areas. Herbaceous dominants are bunchgrasses, primarily Bluebunch Wheatgrass



Legend

 StudyArea	 Other USDA
Land Ownership	 U.S. Fish & Wildlife Service
 Bureau of Land Management	 State Trust
 National Park Service	 MT Fish, Wildlife & Parks
 U.S. Forest Service	 Private
	 Water
	 Towns

Figure 2. Map of the study area.

(*Pseudoroegneria spicata*), Idaho Fescue (*Festuca idahoensis*), Needle-and-Thread (*Hesperostipa comata*), Sandberg's Bluegrass (*Poa secunda*), and Blue Grama (*Bouteloua gracilis*).

Riparian forests form a conspicuous wetland feature in the study area. Smaller order streams often support dense stands of willows, such as Geyer's Willow (*Salix geyeriana*), Drummond's Willow (*Salix drummondiana*), and Booth's Willow (*Salix boothii*), interspersed with sedge meadows of Beaked Sedge (*Carex utriculata*), Water Sedge (*Carex aquatilis*), and Tufted Hairgrass (*Deschampsia caespitosa*). Larger rivers often support large galleries of cottonwood. Black Cottonwood (*Populus balsamifera* ssp. *trichocarpa*) is the most abundant species, although Narrowleaf Cottonwood (*Populus angustifolia*) and Plains Cottonwood (*Populus deltoides* ssp. *monilifera*) are also present.

Cottonwood stands range from open canopied woodlands to closed canopy forests. More mesic floodplain stands can be lush, with a well-developed and diverse shrub layer, including Peachleaf Willow (*Salix amygdaloides*), Red-osier Dogwood (*Cornus sericea*), Yellow Willow (*Salix lutea*), Chokecherry (*Prunus virginiana*), Western Snowberry (*Symphoricarpos occidentalis*), Wood Rose (*Rosa woodsii*), and Silver Buffaloberry (*Shepherdia argentea*). Drier stands on terraces often have no shrub component at all or a less diverse shrub layer dominated by Western Snowberry or Wood Rose. The native grasses that once characterized these stands, such as Western Wheatgrass (*Pascopyrum smithii*) and Thickspike Wheatgrass (*Elymus lanceolatus*), have now largely been replaced by exotic pasture grasses, primarily Kentucky Bluegrass (*Poa pratensis*) and Smooth Brome (*Bromus inermis*). Grazing has also greatly altered these communities in places by shifting shrub composition to favor less palatable species, such as rose and snowberry, or in more extreme cases, by reducing or eliminating shrub cover overall.

Cottonwoods are highly dependent on fluvial processes for regeneration. Cottonwoods produce abundant seeds that are released from May to July (Braatne et al. 1996), generally after peak flood flows. These seeds need bare, moist substrate to successfully germinate. Most successful cottonwood reproduction is associated with floods that recur on average every 5 to 10 years (Bradley and Smith 1986, Scott et al. 1997, Mahoney and Rood 1998). These moderate floods drive erosional and depositional processes and deposit fresh alluvium on point and lateral bars, thereby creating suitable "regeneration niches" for cottonwood recruitment. Five to 10 year flood flows allow seedlings to establish high enough on these fluvial surfaces to survive subsequent flooding (Auble and Scott 1998). After initial establishment, seedlings require a gradual decline in streamflow (approximately 2.5 cm/day) to prevent mortality due to desiccation (Amlin and Rood 2002). Given these limitations, successful seedling recruitment is episodic and relatively rare, even along free-flowing streams (Mahoney and Rood 1998).

Historically, beaver (*Castor canadensis*) played a key role in wetland development in the study area. Beaver actively create wetlands by felling trees and creating impoundments, thereby greatly increasing the diversity and extent of wetland habitats (Naiman et al. 1988, Johnston and Naiman 1990a, Johnston and Naiman 1990b, Ray et al. 2001). Current low beaver population levels and extirpation from some streams will likely lead to a net loss of wetland habitat in the region.

Non-riverine wetlands in the study area are diverse and have formed through various processes. Many montane wetlands were formed through glacial processes. For example, depressional wetlands are largely associated with glacial landforms, such as cirques and moraines. Groundwater discharge zones also create wetlands, including some montane fens and a large marsh on a terrace of the Jefferson River.

METHODS

Site Identification and Selection

The principle criteria used to initially select wetlands for inventory were ecological integrity and conservation significance. Specifically, we sought wetlands without hydrologic or geomorphic modification that had intact, representative native plant communities and that supported rare species or communities or had outstanding wildlife habitat. We consulted several sources of information to identify potential high quality wetlands. Expert opinion from local resource managers, biologists, and hydrologists provided the best site-specific information and most promising leads for follow-up. Agencies and organizations consulted included the U.S. Forest Service, Bureau of Land Management, Natural Resources Conservation Service, U.S. Fish and Wildlife Service, local Conservation Districts, Montana Departments of Fish, Wildlife & Parks and Natural Resources and Conservation, The Nature Conservancy, Montana Land Reliance, Gallatin Valley Land Trust, Jefferson River Watershed Council, University of Montana Riparian and Wetland Research Program, and ecological consultants. We also checked Heritage databases for known occurrences of wetland-dependent special status plants and animals and inspected U.S. Geological Survey topographic quad maps and aerial photographs to identify potentially important wetlands. In all, these data sources revealed 25 potential high quality wetland sites.

Once potential sites were identified, we used the above criteria to prioritize our inventory efforts. We emphasized wetlands with intact hydrologic regimes and geomorphology that support high quality native plant communities or populations of rare plants or animals. We also considered landscape context, ownership, and management. For example, because of the greater potential for development, wetlands and riparian areas on private lands received greater inventory attention than those on state or federal lands. Where potential inventory sites were partly or wholly in private ownership, we requested landowner

permission for access. In cases where permission was denied, the site was dropped from the priority list.

Data Collection

Sites were surveyed in the summer of 2001. Montana Natural Heritage Program ecologists used a standardized methodology based on Bourgeron et al. (1992) to assess site condition, catalog community types, and document rare plant and animal occurrences. Specifically, we attempted to walk through all wetland plant communities at any given site, except where prevented by deep water or denial of landowner permission. For each dominant plant community, we collected environmental and species composition and coverage data from 50-m² relevé plots. Plots were placed subjectively but without preconceived bias to characterize representative plant communities (Mueller-Dombois and Ellenberg 1974). Abundance values of all vascular and bryophyte plant species present were recorded using cover classes similar to U.S. Forest Service ECODATA methods (Jensen et al. 1994). Where applicable, plant communities were classified using Hansen et al. (1995) or NatureServe (2003). The condition of each community was assessed using criteria such as the presence of exotic species, evidence of logging, hummocking or pugging, presence of ditches, dikes, riprap, and other geomorphic and hydrologic modifications. We also noted the depth of standing water and presence of beaver activity. Additional environmental parameters recorded include elevation, aspect, slope, hydrogeomorphic (HGM) class and subclass (Smith et al. 1995), as well as Cowardin system/subsystem, class/subclass, and hydrologic regime (Cowardin et al. 1979). On- and off-site land uses were also recorded. A cursory search for rare plants was conducted during the walk-through of each wetland.

No formal wetland delineations or functional assessments were conducted; however, Heritage Program ecologists do use two regional HGM models developed by researchers at the Flathead Lake Biological Station (Hauer et al. 2002a,

Hauer et al. 2002b). For example, we measured the depth of the O and A soil horizons at some sites. This variable is measured in the intermontane pothole HGM model; it represents the long-term store of nutrients in the soil and acts as an index of the characteristic decomposer community in the wetland (Hauer et al. 2002a). For instance, a very thick A horizon can indicate an excessive amount of upland erosion is taking place.

Data Management

The Montana Natural Heritage Program maintains four types of database records for information gathered in the wetland inventory: community plot records, community and species occurrence records, site records, and community abstracts. Wetland community plot information (i.e., species composition and cover and environmental data) was entered into a relational database that is similar to the U.S. Forest Service ECODATA system used for managing ecological data.

Community occurrence records were created for each wetland community ranked as having outstanding quality or considered rare or imperiled. Community occurrence information (e.g., HGM class, Cowardin class/subclass, dominant species, hydrology, landscape setting) was summarized and entered in the Biotics data system, a database developed by NatureServe and used by programs throughout the Natural Heritage Network. Summary information about each site as a whole (e.g., general site descriptions, ecological diversity, on- and off-site land uses, management needs) was also entered into a site file in Biotics, and the boundaries of each wetland site were digitized as polygons and stored in a Geographic Information System.

Site and Community Ranking

Community Rarity Ranks (State and Global Ranks)

We ranked the rarity and conservation significance of individual plant community types using criteria analogous to those used for ranking plant and animal species. This ranking system is intended to help managers identify elements at risk and determine management and conservation priorities. Community ranks are based primarily on the total number of occurrences and area occupied by the community type, either rangewide (for global or G ranks) or statewide (for state or S ranks). In addition, information on condition, threats, trend, and fragility are considered when known. The ranks are scaled from 1 to 5, with G1 indicating that the community is critically imperiled rangewide, and a G5 indicating no risk of extinction. Guidelines used to assign community ranks are included in Appendix A.

Community Viability Ranks

Each individual wetland community occurrence was also quality-ranked using criteria developed by The Nature Conservancy and the Natural Heritage Network (NatureServe 2002). For each community, we evaluated its condition, landscape context, and size. Each factor was rated A – D (numeric equivalents of 4 – 1), with A being excellent and D being poor. These factors were weighted by their relative ecological importance. Wetland and riparian communities usually occur as small patches or linear stringers in the landscape; thus they are highly dependent on external factors, such as flooding regimes and upland condition. When evaluating a community's overall quality, we considered condition and landscape context to be of primary importance and size secondary. Therefore, in calculating the community viability rank, condition and landscape context each accounted for 45 percent of the overall rank and size accounted for 10 percent. An overall site rank was then calculated, where A was between 3.25 and 4.00, B between 2.50 and 3.25, C between 1.75, and 2.50, and D was less than 1.75.

Site Ranks

We evaluated wetland sites using criteria similar to those used to assess community viability ranks. In addition to condition, landscape context, and size, two other factors important for assessing conservation significance were considered: diversity and rarity. Site evaluation criteria were developed in conjunction with regional wetland assessment protocols (Washington State Department of Ecology 1991, Chadde et al. 1998, Greenlee 1999, Jankovsky-Jones 1999), regional hydrogeomorphic functional assessments (Hruby et al. 1999, Jankovsky-Jones et al. 1999a, Jankovsky-Jones et al. 1999b, Hruby et al. 2000, Hauer et al. 2002a, Hauer et al. 2002b), and plant community ranking specifications developed by other Natural Heritage Programs (Chappell and Christy 2000, Rondeau and Sanderson 2000).

Table 1 describes the indicators for and relative importance of each factor; the complete criteria are presented in Appendix C. Similar to community viability ranks, each site was evaluated by the five factors and assigned an overall rank of A – D. Each factor was weighted by its relative importance in assessing a site's overall ecological and conservation significance. Condition and landscape context were of primary importance and each factor accounted for 25% of a site's overall rank. Diversity and rarity were secondary factors, with each accounting for 20% of the site rank. The tertiary factor was size, which accounted for 10% of the overall site rank. These ranks correspond to the previous ranking system used in Greenlee (1999) and Cooper et al. (2000) as follows:

A = outstanding ecological significance
B = very high and high ecological significance
C = moderate ecological significance
D = not significant

The general characteristics of A- to D-ranked sites are described below.

A-ranked Sites

These wetlands have the greatest ecological and conservation significance. A-ranked sites are in

good to excellent condition with intact, high quality examples of native plant communities, and few to no exotic species. There are minimal anthropogenic influences at these sites or in their surrounding uplands; therefore, wetland functions are largely intact and will most likely fall within the range of natural variation. These sites often support a diverse array of plant communities and other important wetland features, including peatlands, beaver ponds, and springs. They also may provide habitat for numerous state and/or globally rare plant and animal species. Impacts to these sites cannot be fully mitigated, and any alterations could lead to significant loss of their distinctive characteristics and value.

B-ranked Sites

Wetland sites in this category generally support diverse, high quality plant communities, but they are distinguished from A-ranked wetlands by having a greater degree of anthropogenic disturbance either on- or off-site (e.g., logging in the uplands near the site, grazing on a portion of the site, etc.). These disturbances are localized or minimal and are restorable. B-ranked sites may support a number of state rare plant or animal species. Most of the wetland plant communities at these sites are in excellent condition, but a few may have moderate impacts. Improvement in resource management at these sites, such as changing grazing management plans or reducing trapping pressure on beaver, would improve the overall suite of wetland functions at these sites.

C-ranked Sites

Generally, C-ranked wetlands have been degraded by systematic hydrologic or geomorphic modifications or by disruptive land uses in the wetland or its surrounding uplands. These sites may still support high quality native plant communities, but exotic species are often widespread. Alternatively, these sites may be homogenous wetlands in good condition dominated by structurally simple, common communities, such as Broadleaf Cattail (*Typha latifolia*) monocultures. Although these wetlands are often degraded, they still provide important functional values, such as moderating flood flows or removing particulates or

Table 1. Indicators and relative importance of criteria used to rank the ecological and conservation significance of wetland sites.

Factor	% of Overall Rank	Indicators
Condition	25%	Alteration of hydrologic, geomorphic, or biogeochemical processes; presence of intact, representative native plant communities with characteristic structure and composition; presence of exotic species or cultural vegetation.
Landscape Context	25%	Extent of land uses in the surrounding uplands that disrupt hydrologic and habitat connectivity among the site, uplands, and adjacent wetlands.
Diversity	20%	Number of plant communities, number of structural vegetation types, number of hydrologic classes.
Rarity	20%	Number and condition of rare plants, animals, or plant communities present at the site.
Size	10%	Size of site.

nutrients, as well as habitat for wetland-dependent wildlife, such as waterfowl. These sites may also support populations of rare species or communities.

D-ranked Sites

D-ranked sites have been significantly affected by hydrologic or geomorphic alterations and often provide poor functional or habitat values. Vegetation at these sites is often degraded with little to no regeneration and exotic weeds or cultural vegetation may be widespread. The uplands may have been converted from native vegetation to agricultural or residential land uses, and the site may suffer from excessive sedimentation, erosion, and nutrient loading or may have become hydrologically isolated. Generally, D-ranked sites are not considered ecologically significant for the purposes of this report. However, these sites may provide locally important habitat values in areas where natural habitats have been largely converted to urban or agricultural land uses.

Plant Community Classification

We defined plant associations based on the International Classification of Ecological Communities (NatureServe 2003). This database, developed by The Nature Conservancy and NatureServe, forms the basis for a standardized National Vegetation Classification. This classification is currently being refined by NatureServe, the Ecological Society of America, and U.S. Geological Survey. It incorporates and

expands on published state and regional plant community classifications, such as Pfister et al. (1977), Mueggler and Stewart (1980), and Hansen et al. (1995). For aquatic communities, we also referred to a classification of aquatic vegetation for western Montana and northern Idaho (Pierce and Jensen 2002).

NatureServe (2003) recognizes many of the wetland and riparian communities described in Hansen et al. (1995), with several exceptions. Hansen et al. (1995) was designed as a management tool and not specifically to address biological diversity. Therefore, it lumps together several dominant and indicator species with similar ecological requirements. In general, we do not follow Hansen et al.'s ecological equivalents. Therefore, we recognize Booth's Willow (*Salix boothii*) distinct from Geyer's Willow (*Salix geyeriana*), Inflated Sedge (*Carex vesicaria*) distinct from Beaked Sedge (*Carex utriculata*), Woolly Sedge (*Carex pellita*) and Buxbaum's Sedge (*Carex buxbaumii*) distinct from Slender Sedge (*Carex lasiocarpa*), Narrow-spiked Reedgrass (*Calamagrostis stricta*) distinct from Bluejoint Reedgrass (*Calamagrostis canadensis*), Softstem Bulrush (*Schoenoplectus tabernaemontani*) distinct from Hardstem Bulrush (*Schoenoplectus acutus*), Black Hawthorn (*Crataegus douglasii*) distinct from Succulent Hawthorn (*Crataegus succulenta*), Prickly Rose (*Rosa acicularis*) distinct from Wood Rose (*Rosa woodsii*), and the native Ticklegrass (*Agrostis scabra*) distinct from the exotic Redtop (*Agrostis stolonifera*).

Nomenclature

Nomenclature follows Kartesz (1999) for vascular plants, Anderson (1990) and Anderson et al. (1990) for mosses, and Stotler and Crandall-Stotler (1977) for liverworts. Collectively, these references form the basis for the national naming standard for plants (USDA and NRCS 2004). Exceptions to this standard were made for two genera where we follow the Flora of North America: *Betula* (Furrow 1997) and *Scorpidium* (=Limprichtia in part, Hedenäs 2000). It should also be noted that we use *Picea engelmannii* (Engelmann Spruce) to include *Picea engelmannii*, *Picea glauca* (White Spruce), and their hybrids (Daubenmire 1974).

RESULTS AND DISCUSSION

Status of Wetland Resources

Twenty-one wetlands were identified in the course of this study (Figure 3). These sites range from pristine wetlands of statewide conservation significance to highly impacted wetlands that still provide important wildlife habitat (Table 2). Detailed site descriptions of these wetlands are presented in Appendix B. Please note that about one third of the sites described occur wholly or in part on private land, and landowner permission is needed to access these sites.

A-ranked Wetlands

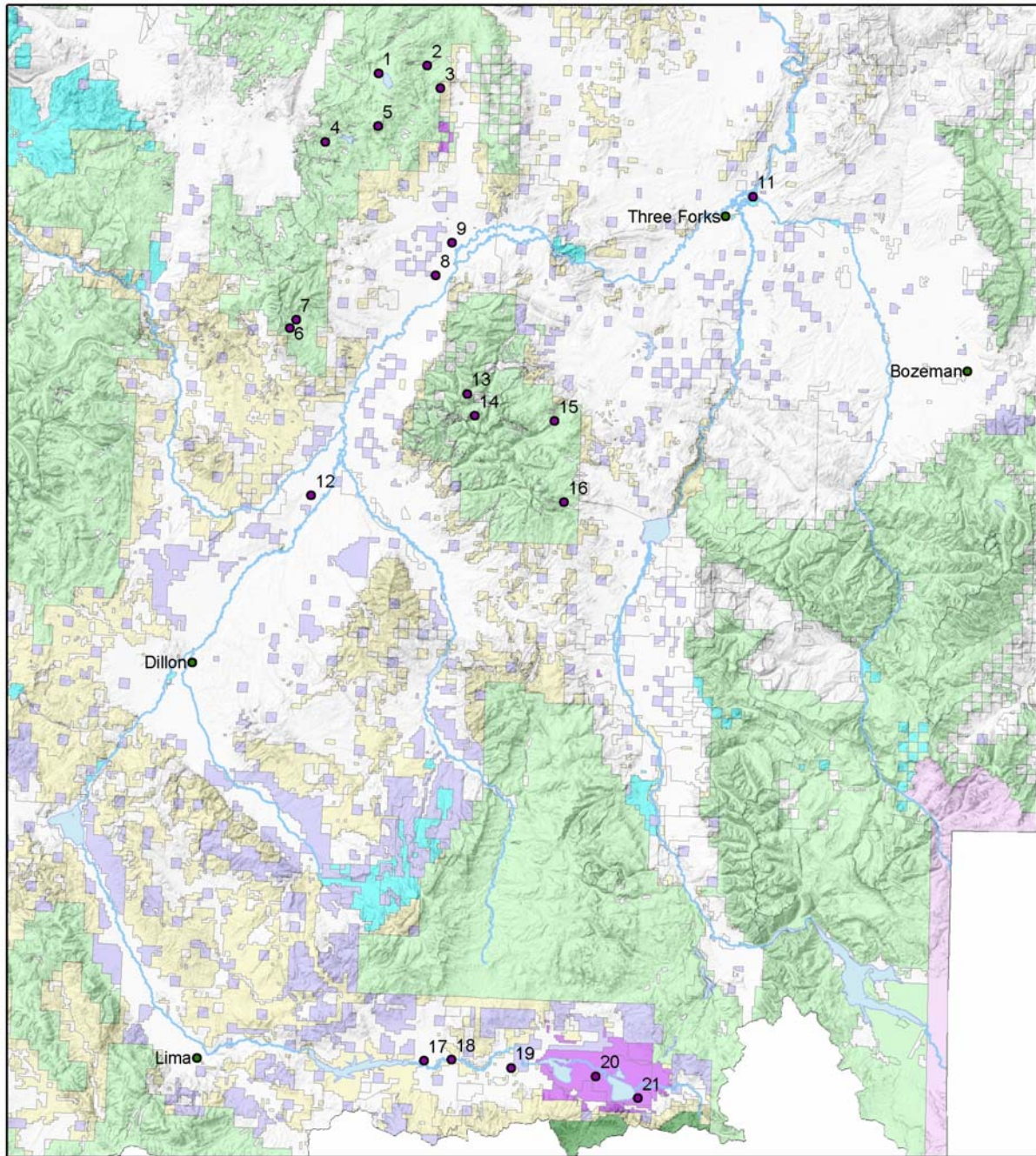
Four of the sites inventoried qualified as A-ranked wetlands. These sites are in good to excellent condition. In general, their natural hydrologic regimes are intact, they support high quality examples of native plant communities, and they have no or only minor weed populations. The uplands surrounding these sites are largely pristine, with minimal human disturbances. Some of these wetlands encompass a broad array of physical environments and thus contain a high diversity of plant communities and structural types.

A-ranked sites include two montane peatlands and two wetland complexes in the Centennial Valley. The peatlands both occur in the subalpine zone of the Tobacco Root Mountains and are largely pristine. They represent high quality examples of subalpine poor fens. Peatlands are a rare wetland type in Montana and are very uncommon in the study area. The other two A-ranked sites occur on the Red Rock Lakes National Wildlife Refuge. The first, Red Rock Lakes, encompasses the bulk of the lacustrine fringe wetlands that occur on the Refuge. Although these wetlands have been hydrologically manipulated by a control structure at the outlet of Lower Red Rock Lake, they still support high quality wetland plant communities and provide habitat for numerous special status species. The last site is a large willow complex that occurs on a shallow alluvial fan southeast of Upper Red Rock Lake. This large slope wetland supports outstanding habitat with numerous small peatland inclusions and an isolated stand of old-growth Engelmann Spruce.

These sites occur on either National Forest or U.S. Fish and Wildlife Service land. The sites on the Red Rock Lakes National Wildlife Refuge enjoy protection from many land uses, although the Refuge does receive some livestock grazing pressure and is heavily browsed by wild ungulates in certain areas. The National Forest lands around the peatland sites are largely managed for recreation and some livestock grazing. Management for all these sites should focus on maintaining their current excellent condition and maintaining or improving their hydrological connectivity to adjacent wetlands.

B-ranked Wetlands

Twelve sites were rated as B-ranked wetlands. In general, these sites have greater human-caused disturbance both on- and off-site. The hydrology of many of these sites has been modified by irrigation practices and past livestock grazing has altered the geomorphology and vegetation composition at some locations. However, these wetlands are still relatively diverse and often have a high functional



Legend

 Bureau of Land Management	 U.S. Fish & Wildlife Service
 National Park Service	 State Trust
 U.S. Forest Service	 MT Fish, Wildlife & Parks
 Other USDA	 Private
 Water	 Wetlands
 Towns	

Wetland Sites

- | | |
|----------------------------|--|
| 1. Upper Whitetail Park | 12. California Slough |
| 2. Beaver Creek | 13. Curly Lake Wetland |
| 3. Hay Creek | 14. Lost Cabin Wetlands |
| 4. O'Neil Creek | 15. Potosi Hot Spring |
| 5. Lost Park | 16. Leonard Creek Fen |
| 6. Upper Hells Canyon | 17. Red Rock Fen |
| 7. Table Mountain Wetlands | 18. Red Rock River/
Centennial Valley |
| 8. Lombardi Meadows | 19. Red Rock Ponds |
| 9. Piedmont Swamp | 20. Red Rock Lakes |
| 10. Three Forks | 21. Red Rock Willows |
| 11. Headwaters | |

Figure 3. Map of locations of surveyed wetlands.

Table 2. Site ranks of wetlands inventoried in the study area.

Site Name	Ranking Factors					Overall Rank
	Condition	Landscape Context	Diversity	Rarity	Size	
Lost Cabin Wetlands	A	A	D	A	A	A
Red Rock Willows	A	A	B	B	A	A
Curly Lake Wetland	A	A	D	A	A	A
Red Rock Lakes	A	A	C	C	A	A
Leonard Creek Fen	A	B	C	A	C	B
Upper Whitetail Park	A	A	C	D	A	B
Piedmont Swamp	B	B	B	B/C	A	B
Lost Park	A	A	B	0	A	B
California Slough	B	B/C	B	B	A	B
Red Rock River / Centennial Valley	B/C	B	A	C	A	B
Table Mountain Wetlands	A	A	C	D	C	B
Red Rock Fen	B	B	D	A	B	B
Upper Hells Canyon	B	B	B	C	C	B
Potosi Hot Spring	A	B	C	D	C	B
Headwaters	B/C	B	B	C	C	B
O'Neil Creek	B	A	C	0	B	B
Lombardi Meadows	B	C	C	B	C	C
Hay Creek	B	B	C	C	D	C
Red Rock Ponds	C	B	B	D	B	C
Beaver Creek	B	B	B	0	C	C
Three Forks	C	C	D	C	C	C

capacity. They also provide important habitats and in most cases support high quality native plant communities.

B-ranked wetlands in the study area represent a diverse array of wetland types. The majority of sites are riverine wetlands. These include Red Rock River, California Slough, Headwaters, Table Mountain Wetlands, Upper Hells Canyon, and O'Neil Creek. Two of these sites, California Slough and Headwaters, support interesting Short-beaked Sedge (*Carex simulata*) communities along small sloughs and distributaries of larger rivers. These communities are formed in shallow peat over gravel and in places support habitat for rare plant species, such as Ute Ladies' Tresses (*Spiranthes diluvialis*), Mealy Primrose (*Primula incana*), and Annual Indian Paintbrush (*Castilleja exilis*). Three of these wetlands, Table Mountain Wetlands, Upper Hells Canyon, and O'Neil Creek, have been either created or enhanced by past beaver activity. Other wetland types in this category include thermal springs (Potosi Hot Spring), peatlands (Leonard Creek

Fen, Red Rock Fen), subalpine and montane parks (Upper Whitetail Park, Lost Park), and a large groundwater discharge wetland (Piedmont Swamp).

The majority of these sites occur on public land, predominantly lands administered by the U.S. Forest Service. None of the sites on public land enjoy protected status, except for Headwaters, which is a State Park, and Lost Park, which is a Research Natural Area. All these sites as well as their immediate uplands should be managed to maintain and enhance their existing functional and habitat values. Similarly, conservation options, such as cooperative agreements or conservation easements, for the wetlands on private land would help maintain the high functional and habitat values of these sites. The private land portion of the Red Rock River site is currently under conservation easement.

C-ranked Wetlands

The remaining five sites were all rated as C-ranked wetlands. Most of these wetlands have

been functionally impaired through hydrologic or geomorphic alterations or through land use disturbances in the wetlands or adjacent uplands. At some sites, exotic species are widespread and abundant. Nonetheless, these wetlands still provide locally important habitat values and in some cases provide critical habitat for rare species.

Except for Red Rock Ponds, all of these sites are associated with riverine wetlands. Red Rock Ponds are a group of depressional wetlands associated with glacial features in the Centennial Valley. The hydrology of these wetlands has been significantly altered by ditching and excavation to augment stock water access. The hydrology of the Three Forks and Lombardi Meadows sites has also been altered to improve pasture and crop production. The final two sites, Beaver Creek and Hay Creek, have intact hydrology but have been affected by past mining activities and invasion by exotic species.

Three of these wetlands occur on private land. As noted under B-ranked wetlands above, conservation options could be pursued that maintain or improve the habitat and functional values of these wetlands. For example, the conservation easement on the Red Rock Ponds site will help maintain the landscape connectivity of these wetlands. Beaver and Hay Creeks are on National Forest lands; management activities that maintained or improved hydrologic functions at these sites would benefit the ecological value of these wetlands.

Plant Communities

Fifty-two wetland- and riparian-associated plant communities were documented in the study area. These communities are presented in Table 3. Community names and conservation ranks are from NatureServe (2003). Appendix D contains detailed descriptions of many of these plant associations.

For the most part, there are few intrinsically rare plant communities in the study area. An exception is the Beaked Sedge (*Eleocharis*

rostellata) herbaceous community. In the study area, this community is known only from thermal springs, where it forms near-monospecific stands on wet mineral soils directly in contact with thermal waters (Lesica 1990). Potosi Hot Spring supports an example of this community. Other wetland communities are common, but due to degradation by human activities, high quality occurrences are relatively rare. This phenomenon is prevalent with many drier wetland communities that are accessible to livestock. For example, on the Jefferson River, high quality cottonwood stands with well-developed native shrub understories, especially mesic floodplain communities with abundant Red-osier Dogwood, are regionally very rare. In many cases, the native shrub component has been converted to an understory dominated by exotic pasture grasses.

The following discussion, organized by Cowardin et al.'s (1979) palustrine subclass, provides general descriptions for the major wetland plant communities found in the study area

Forested Vegetation

Forested wetland communities in the study area are mainly associated with riverine systems. These communities reach their greatest extent along the lower reaches of the larger rivers where large floodplains can support extensive stands of cottonwood. Black Cottonwood is the dominant species in the area; Narrowleaf Cottonwood is also common and Plains Cottonwood is present although rare. Fluvial processes, such as flooding and the resulting bank erosion and deposition, are essential to cottonwood regeneration and the long-term persistence of these habitats. Cottonwood recruitment is still occurring on the lower reaches of the Jefferson, Madison, and Gallatin Rivers; however, in many places, the quality of these habitats has been degraded through the loss of riparian shrub understories. For example, on the Jefferson River, very few cottonwood stands support a diverse understory of tall mesic shrubs, such as Red-osier Dogwood, Yellow Willow, and Chokecherry. Instead, most stands

Table 3. Conservation ranks of wetland and riparian plant communities documented within the study area. Communities are arranged by Cowardin system, class, and subclass.

		Conservation Rank*	
Scientific Name	Common Name	State	Global
PALUSTRINE FORESTED, NEEDLE-LEAVED EVERGREEN			
<i>Picea engelmannii</i> / <i>Equisetum arvense</i>	Engelmann Spruce / Field horsetail	S4	G4
<i>Picea engelmannii</i> / <i>Calamagrostis canadensis</i>	Engelmann Spruce / Bluejoint Reedgrass	S4	G4
<i>Picea engelmannii</i> / <i>Carex scopulorum</i>	Engelmann Spruce / Holm's Rocky Mountain Sedge	*	G3
PALUSTRINE FORESTED, BROAD-LEAVED DECIDUOUS			
<i>Populus balsamifera</i> ssp. <i>trichocarpa</i> / <i>Cornus sericea</i>	Black Cottonwood / Red-osier Dogwood	S3?	G3?
<i>Populus balsamifera</i> ssp. <i>trichocarpa</i> / Mesic graminoids	Black Cottonwood / Mesic graminoids	SW	*
<i>Populus balsamifera</i> ssp. <i>trichocarpa</i> / <i>Symphoricarpos occidentalis</i>	Black Cottonwood / Western Snowberry	S3?	*
<i>Populus tremuloides</i> / <i>Poa pratensis</i>	Quaking Aspen / Kentucky Bluegrass	*	*
PALUSTRINE SCRUB-SHRUB			
<i>Alnus incana</i> / Mesic graminoids	Mountain Alder / Mesic graminoids	*	G3
<i>Betula glandulosa</i> / <i>Carex utriculata</i>	Bog Birch / Beaked Sedge	S4	G4?
<i>Salix bebbiana</i>	Bebb Willow	S3?	G3?
<i>Salix boothii</i> / <i>Calamagrostis canadensis</i>	Booth's Willow / Bluejoint Reedgrass	S3	S3S4Q
<i>Salix boothii</i> / <i>Carex utriculata</i>	Booth's Willow / Beaked Sedge	S4	G4
<i>Salix boothii</i> / Mesic graminoids	Booth's Willow / Mesic graminoids	SP	G3?
<i>Salix candida</i> / <i>Juncus balticus</i>	Hoary Willow / Baltic Rush	*	*
<i>Salix drummondiana</i> / <i>Carex utriculata</i>	Drummond's Willow / Beaked Sedge	S4	G4
<i>Salix exigua</i>	Sandbar Willow	S5	G5
<i>Salix geyeriana</i> / <i>Carex utriculata</i>	Geyer's Willow / Beaked Sedge	S5	G5
<i>Salix geyeriana</i> / Mesic graminoids	Geyer's Willow / Mesic graminoids	*	G3
<i>Salix lutea</i> / <i>Carex utriculata</i>	Yellow Willow / Beaked Sedge	S4	G4
<i>Salix lutea</i> / <i>Juncus balticus</i>	Yellow Willow / Baltic Rush	*	*
<i>Salix planifolia</i> / <i>Carex aquatilis</i>	Planeleaf Willow / Water Sedge	S3	G5
<i>Salix wolfii</i> / <i>Carex aquatilis</i>	Wolf Willow / Water Sedge	S3	G4
<i>Salix wolfii</i> / <i>Juncus balticus</i>	Wolf Willow / Baltic Rush	*	*
<i>Sarcobatus vermiculatus</i> / <i>Distichlis spicata</i>	Greasewood / Saltgrass	S2	G4
<i>Shepherdia argentea</i>	Silver Buffaloberry	S3?	G3G4
PALUSTRINE EMERGENT			
<i>Calamagrostis canadensis</i>	Bluejoint Reedgrass	S4	G4
<i>Carex aquatilis</i>	Water Sedge	S4	G5
<i>Carex nebrascensis</i>	Nebraska Sedge	S4	G4
<i>Carex praegracilis</i>	Clustered Field Sedge	S3S4	G3G4
<i>Carex praegracilis</i> – <i>Carex aquatilis</i>	Clustered Field Sedge – Water Sedge	SP	G3
<i>Carex scopulorum</i>	Holm's Rocky Mountain Sedge	S4	G5
<i>Carex simulata</i>	Short-beaked Sedge	S3	G4
<i>Carex utriculata</i>	Beaked Sedge	S5	G5
<i>Deschampsia caespitosa</i>	Tufted Hairgrass	S4	G4
<i>Distichlis spicata</i>	Saltgrass	S4	G5
<i>Eleocharis palustris</i>	Common Spikerush	S5	G5
<i>Eleocharis rostellata</i>	Beaked Spikerush	S1	*
<i>Hordeum jubatum</i>	Foxtail Barley	S4	G4
<i>Juncus balticus</i>	Baltic Rush	S5	G5
<i>Juncus balticus</i> – <i>Carex praegracilis</i>	Baltic Rush – Clustered Field Sedge	*	*
<i>Leymus cinereus</i> – <i>Puccinellia nuttalliana</i>	Basin Wildrye	*	*

Table 3, continued

Scientific Name	Common Name	Conservation Rank*	
		State	Global
<i>Pascopyrum smithii</i> – <i>Distichlis spicata</i>	Western Wheatgrass – Saltgrass	SP	G4
<i>Schoenoplectus acutus</i>	Hardstem Bulrush	S5	G5
<i>Schoenoplectus pungens</i>	Threesquare	S3	G3G4
<i>Spartina gracilis</i>	Alkali Cordgrass	SP	GU
<i>Triglochin maritima</i>	Seaside Arrowgrass	*	GU
<i>Typha latifolia</i>	Broadleaf Cattail	S5	G5
PALUSTRINE AQUATIC BED, ROOTED AND FLOATING VASCULAR			
<i>Potamogeton foliosus</i>	Leafy Pondweed	*	G3?
<i>Potamogeton richardsonii</i> – <i>Myriophyllum spicatum</i>	Redhead Pondweed – Water-milfoil	S2Q	G2Q
<i>Zanichellia palustris</i>	Horned Pondweed	*	*

* Please see Appendix A for rank definitions

are now dominated by low shrubs, such as Western Snowberry and Wood Rose, or exotic pasture grasses, such as Kentucky Bluegrass and Smooth Brome. Many of these changes may be grazing induced, although hydrological alterations and beaver eradication may also play an important role. At higher elevations, forested floodplains become dominated by stands of Engelmann Spruce or Subalpine Fir. Quaking Aspen may be locally dominant in some riverine settings; however, it is more common in mesic swales and slope wetlands, often occurring in small patches.

Scrub-Shrub Vegetation

Riparian and wetland shrublands in the study area occur in many hydrogeomorphic settings, including riverine terraces and floodplains, around beaver ponds, in slope wetlands, and on the margins of marshes and lakes. Various species of willows often dominate these shrublands. At higher elevations, Planeleaf Willow (*Salix planifolia*) and Wolf Willow (*Salix wolfii*) are common, often forming communities in montane parks with saturated soils on the margins of beaver ponds. At middle elevations, riparian zones are often dominated by Geyer's, Drummond's, and Booth's Willows. Stands of these willows occur on floodplains and in swales along low-gradient streams and rivers and as a mosaic with marsh vegetation in wet meadow complexes (often with some beaver influence). Yellow Willow is common in

riverine floodplains at lower elevations. Sandbar Willow (*Salix exigua*) stands dominate active and recently stabilized gravel and sandbars at low to mid elevations. Hoary Willow (*Salix candida*) is often the dominant shrub in study area peatlands.

Several non-willow communities are common in the study area. Mountain Alder (*Alnus incana*) and Water Birch (*Betula occidentalis*) are dominant in springs and seeps and along high gradient streams. Western Snowberry, Wood Rose, Basin Big Sagebrush, and Chokecherry are common and locally dominant in riverine floodplains and terraces. Greasewood is a common dominant on subirrigated alkali slopes and around alkali lakebeds.

Emergent Vegetation

Native herbaceous emergent vegetation is also common in a variety of hydrogeomorphic settings, including peatlands, marshes, potholes, beaver ponds, wet meadows, lake edges, oxbows, and sloughs. Herbaceous wetland vegetation is usually a complex mosaic of monocultures, due to the rhizomatous habit of many of the constituent species. Common dominant marsh species include Beaked Sedge, Water Sedge, Threesquare (*Schoenoplectus pungens*), Common Spikerush (*Eleocharis palustris*), Hardstem Bulrush (*Schoenoplectus acutus*), and Broadleaf Cattail. Sloughs support similar communities, with the addition of Short-

beaked Sedge. Many of these wetlands are still relatively intact. One potential conservation issue is the dominance of cattail in some of these wetlands. Broadleaf Cattail is a competitively dominant species in many wetlands in North America (Wisheu and Keddy 1992, Gaudet and Keddy 1995) that increases in abundance with increasing nutrient inputs, especially nitrogen (Neill 1990). Some cattail populations in Montana may also be a *Typha* \times *glaucia*, a hybrid between *T. latifolia* and *T. angustifolia* (Narrowleaf Cattail), which can be a more aggressive colonizer that can out-compete its parent species (Harris and Marshall 1963, Smith 2000). Fertilizer run-off and discharge of septic effluent to water bodies can cause rapid nutrient increases and can lead to increased dominance of either of these species, thereby reducing the species richness and diversity of affected wetlands and limiting habitat for rare species.

Drier herbaceous-dominated wetlands, such as wet meadows and riparian terrace grasslands, have been greatly affected by grazing and other land uses and also by invasive exotic species. Although intact wet meadow communities are still relatively common at higher elevations, many valley bottoms that once supported Tufted Hairgrass and Bluejoint Reedgrass communities are now dominated by exotics like Redtop, Kentucky Bluegrass, Smooth Brome, Common Timothy (*Phleum pratense*), and Reed Canarygrass (*Phalaris arundinacea*). This conversion has also affected Western Wheatgrass communities on riparian floodplains and terraces.

Emergent vegetation is a conspicuous component of alkali lake margins, especially in the Centennial Valley, where large flats are dominated by Clustered Field Sedge (*Carex praegracilis*), Baltic Rush (*Juncus balticus*), Nuttall's Alkaligrass (*Puccinellia nuttalliana*), Saltgrass (*Distichlis spicata*), Mat Muhly (*Muhlenbergia richardsonis*), and Basin Wildrye (*Leymus cinereus*).

Common herbaceous dominants in fens include Short-beaked Sedge, Water Sedge, Hoary Sedge (*Carex canescens*), and Few-flowered Spikerush (*Eleocharis quinqueflora*). Most fens also

support an extensive bryophyte layer. Common dominant mosses include *Sphagnum magellanicum*, *Tomentypnum nitens*, *Aulacomnium palustre*, *Scorpidium revolvens*, *Bryum pallescens*, and *Campylium stellatum*.

Herbaceous wet meadows that have been converted from native vegetation represent a major restoration challenge. In addition to exotic pasture grasses, noxious weeds were most common in herbaceous vegetation types. Among the most widespread are Canada Thistle (*Cirsium arvense*), Spotted Knapweed (*Centaurea biebersteinii*), Hound's Tongue (*Cynoglossum officinale*), and Leafy Spurge (*Euphorbia esula*).

Aquatic Bed Vegetation

Aquatic communities occur in the littoral (less than 2-m deep) and limnetic (more than 2-m deep) zones of ponds and lakes or on the beds of low gradient, slow-moving perennial streams. Yellow Pond-Lily (*Nuphar lutea* ssp. *polysepala*), a floating-leaved species, is a common dominant aquatic species. Other common dominants, which range from completely to partly submersed, include Narrowleaf Bur-reed (*Sparganium angustifolium*), Water Milfoil (*Myriophyllum* spp.), Common Mare's Tail (*Hippuris vulgaris*), Leafy Pondweed (*Potamogeton foliosus*), Redhead Pondweed (*Potamogeton richardsonii*), Coon's-Tail (*Ceratophyllum demersum*), and Horned Pondweed (*Zanichellia palustris*).

Plant Species of Concern

Twenty-six plant species of conservation concern associated with wetland habitats have been documented from the study area (Table 4). All these species but one, the peat-moss *Sphagnum magellanicum*, are vascular plants. Four species are regional endemics that are globally vulnerable (G2): Idaho Sedge (*Carex idahoensis*), Storm Saxifrage (*Saxifraga tempestiva*), Ute Ladies' Tresses, and Northwestern Thelypodium (*Thelypodium paniculatum*). Ute Ladies' Tresses is one of three plant species in Montana listed under the

Table 4. Special status species associated with wetland or riparian habitats that have been documented as occurring in the study area by the Montana Natural Heritage Program.

Scientific Name	Common Name	Conservation Rank*		Management Status**		
		State	Global	USFWS	USFS	BLM
Vascular Plants						
<i>Aquilegia formosa</i>	Sitka Columbine	S2	G5			
<i>Atriplex truncata</i>	Wedge-leaved Saltbush	S1	G5			W
<i>Carex idaho</i>	Idaho Sedge	S2	G2Q			S
<i>Carex multicosata</i>	Many-ribbed Sedge	S1	G5			W
<i>Castilleja exilis</i>	Annual Indian Paintbrush	S2	G5			
<i>Castilleja gracillima</i>	Slender Indian Paintbrush	SU	G3G4Q		S	W
<i>Cypripedium parviflorum</i>	Small Yellow Lady's-slipper	S3	G5		S	W
<i>Downingia laeta</i>	Great Basin Downingia	S1	G5			W
<i>Eleocharis rostellata</i>	Beaked Spikerush	S2	G5		S	W
<i>Epipactis gigantea</i>	Giant Helleborine	S2	G3G4		S	W
<i>Juncus hallii</i>	Hall's Rush	S2	G4G5		S	S
<i>Kobresia simpliciuscula</i>	Simple Kobresia	S2	G5			
<i>Penstemon whippleanus</i>	Whipple's Beardtongue	S1	G5			S
<i>Polygonum douglasii</i> ssp. <i>austinae</i>	Austin's Knotweed	S2	G5T4		S	S
<i>Primula incana</i>	Mealy Primrose	S2	G4G5			W
<i>Puccinellia lemmonii</i>	Lemmon's Alkaligrass	S1	G4			
<i>Ranunculus hyperboreus</i>	High-arctic Buttercup	S1	G5			
<i>Saxifraga tempestiva</i>	Storm Saxifrage	S2	G2		S	S
<i>Selaginella selaginoides</i>	Low Spike-moss	S2	G5			
<i>Spiranthes diluvialis</i>	Ute Ladies' Tresses	S2	G2	LT		W
<i>Stellaria crassifolia</i>	Fleshy Stitchwort	S1	G5			W
<i>Taraxacum eriophorum</i>	Rocky Mountain Dandelion	S2	G4			S
<i>Thelypodium paniculatum</i>	Northwestern Thelypody	SH	G2			S
<i>Thelypodium sagittatum</i> ssp. <i>sagittatum</i>	Slender Thelypody	S2	G4T			
<i>Viguiera multiflora</i>	Many-flowered Viguiera	S1	G4G5			
Nonvascular Plants						
<i>Sphagnum magellanicum</i>		S1	G5			
Invertebrates						
<i>Enallagma optimolocus</i>	Last Best Place Damselfly	S1S3	G1G3Q			
<i>Erythemis collocata</i>	Western Pondhawk	S1S2	G5			
<i>Euphydryas gillettii</i>	Gillette's Checkerspot	S2	G2G3			
Fish						
<i>Oncorhynchus clarki lewisi</i>	Westslope Cutthroat Trout	S2	G4T3			SS
<i>Thymallus arcticus montanus</i>	Montana Arctic Grayling	S1	G5T1Q	C		SS
Birds						
<i>Aegolius funereus</i>	Boreal Owl	S4	G5			SS
<i>Charadrius montanus</i>	Mountain Plover	S2B	G2	PT		SS
<i>Cygnus buccinator</i>	Trumpeter Swan	S2B	G4			SS
<i>Falco peregrinus</i>	Peregrine Falcon	S2B	G4	LE		SS
<i>Haliaeetus leucocephalus</i>	Bald Eagle	S3B	G4	LT		SS
<i>Larus pipixcan</i>	Franklin's Gull	S3B	G4G5			
<i>Nycticorax nycticorax</i>	Black-crowned Night-heron	S3B	G5			
<i>Plegadis chihi</i>	White-faced Ibis	S1B	G5			SS
<i>Sterna forsteri</i>	Forster's Tern	S2B	G5			

Table 4, continued

		Conservation Rank*		Management Status**		
Scientific Name	Common Name	State	Global	USFWS	USFS	BLM
Mammals						
<i>Corynorhinus townsendii</i>	Townsend's Big-eared Bat	S2S3	G4			SS
<i>Myotis thysanodes</i>	Fringed Myotis	S3	G4G5			
<i>Spilogale gracilis</i>	Western Spotted Skunk	S1	G5			
<i>Ursus arctos horribilis</i>	Grizzly Bear	S3	G4T3T4	LT		SS

* Please see Appendix A for rank definitions

** BLM = Bureau of Land Management, USFWS = U.S. Fish and Wildlife Service, USFS = U.S. Forest Service; C = candidate species, LE = listed endangered, LT = listed threatened, PT = proposed threatened, S = sensitive species, SS = special status species, W = watch species

Endangered Species Act. The remaining species, though of limited extent in Montana, are globally secure. Some of these species, such as Ute Ladies' Tresses, Mealy Primrose, Annual Indian Paintbrush, and Slender Thelypody (*Thelypodium sagittatum* ssp. *sagittatum*) among others, occur in Montana only in the southwestern portion of the state.

Animal Species of Concern

Eighteen special status animals associated with wetland habitats have been documented from the study area (Table 4). The largest concentrations of these animals are associated with the large lakes found on the Red Rock Lakes National Wildlife Refuge in the Centennial Valley. These include Peregrine Falcon (*Falco peregrinus*) and breeding populations of Trumpeter Swan (*Cygnus buccinator*), Bald Eagle (*Haliaeetus leucocephalus*), Franklin's Gull (*Larus pipixcan*), Black-crowned Night-heron (*Nycticorax nycticorax*), White-faced Ibis (*Plegadis chihi*), Forster's Tern (*Sterna forsteri*), and Montana Arctic Grayling (*Thymallus arcticus montanus*). Other species, including Townsend's Big-eared Bat (*Corynorhinus townsendii*), Fringed Myotis (*Myotis thysanodes*), Western Spotted Skunk (*Spilogale gracilis*), Grizzly Bear (*Ursus arctos horribilis*), and Gillette's Checkerspot (*Euphydryas gillettii*), utilize various riparian habitats, such as cottonwood- or shrub-dominated bottomlands.

Conservation Implications

At the national scale, the rate of wetland loss has been recently estimated at 58,500 acres per year (Dahl 2000, figure is for the period from 1986 to 1997). Although a substantial number, this represents a significant reduction in the rate of loss when compared to the period from the previous decade (Dahl 2000). Although the extent of wetland loss is unknown for the study area, the rate of loss in the region has probably followed national trends and is less today than it has been historically. In the study area, the greater impact to the ecological functioning of wetlands has probably been through the degradation of wetland condition and functional capacity.

Human activities, such as livestock grazing, mining, timbering, agriculture, and development, can impair wetlands by altering their hydrology, geomorphology, and vegetation and by fragmenting hydrologic and habitat connectivity between wetlands and between wetlands and their surrounding uplands. Many wetlands in the study area have been significantly affected by hydrologic alterations to support irrigated agriculture. This is especially true of the larger rivers, such as the Jefferson River, where flows may be substantially appropriated for irrigation purposes. Maintaining instream flows on these rivers is critical in not only preserving the outstanding fisheries of these systems, but the entire riparian ecosystem.

Exotic species are a widespread cause of impairment, and most wetlands in the study area have experienced some shift in species composition due to invasion by exotic species. The presence of exotic species in a wetland may be indicative of past livestock grazing or other ground disturbance, although some wetlands, such as riparian areas frequently disturbed by flooding, are highly susceptible to invasion by exotics. Flooding creates bare substrate that can be easily colonized by seeds of exotic species washed downstream from infestations higher in the watershed. Leafy Spurge and Reed Canarygrass are exotic species that can dominate these early successional habitats. Merigliano and Lesica (1998) hypothesize that both native and exotic genotypes of Reed Canarygrass exist in Montana, with the exotic genotypes being responsible for the dense monocultures of this grass in some wetlands. Populations of exotic origin may be responsible for the aggressive spread of Reed Canarygrass in Montana wetlands.

For the most part, however, exotic species are more established in “drier” wetland communities, such as mature cottonwood stands, wet meadows, mesic aspen stands, and willow / Bluejoint Reedgrass communities. Long-term grazing pressure and other land uses in these communities (and direct seeding in some cases) have facilitated the spread of exotic pasture grasses, such as Smooth Brome, Redtop, Kentucky Bluegrass, and Common Timothy, and noxious weeds, including Leafy Spurge, Canada Thistle, Spotted Knapweed, and Hound’s Tongue. Preventing the spread of exotic weeds and eradicating existing weed populations is a daunting task. An excellent example of an effective weed control program is being implemented in the Centennial Valley where local landowners, in collaboration with the U.S. Fish and Wildlife Service and The Nature Conservancy, are aggressively controlling the spread of exotics. This approach could be successfully applied to other areas in the study area.

Wetlands Not Inventoried

There are a number of wetlands in the study area that were not surveyed as part of this inventory project. Readers should not infer that these uninventoried wetlands are in poor condition or have low functional integrity. Indeed, potentially high quality wetlands identified during the site selection process were not inventoried in cases where landowners did not grant access permission. Lack of access has resulted in the Madison and Gallatin portions of the study area being under-represented in this study.

Many other wetlands did not meet our initial selection criteria and were not prioritized for inventory. However, most of these wetlands do provide important wetland functions and are valuable for that reason alone. Except as noted above, we expect that most wetlands not inventoried as part of this project would qualify as B- or C-ranked wetlands. Many wetlands in the watershed have been fragmented by roads or have had their native wetland plant communities degraded by a variety of land uses. Others are pristine, but very small and dominated by just one or two plant communities. We believe that the B- and C-ranked sites that were inventoried represent a fairly representative sample of these types of wetlands.

Because we focused where possible on large, fairly discrete wetlands, some types of wetlands and processes were likely under-emphasized during the inventory. Examples include small spring/seeps or other smaller wetlands that may harbor rare species. In addition, some fluvial processes (like deposition, channel migration, and flooding) occur at a larger scale than our assessment methods were designed to address. Riparian cottonwood communities are inextricably tied to such processes, and simply protecting existing patches of mature cottonwood forest cannot conserve these communities. Areas where deposition is

occurring (where future cottonwood stands will be recruited) are worthy of conservation as well (Merigliano and Polzin 2003).

How This Information Can Be Used

The purpose of this wetland inventory is to provide information that will assist in the conservation of wetland diversity and quality. The resulting information can be used to:

Prioritize wetlands for conservation

This inventory provides a list of wetland sites ranked by ecological significance. This list can be used to efficiently prioritize how limited wetland protection funds are spent by land trusts considering conservation easements, or by state/federal agencies and corporate owners considering easements or land exchanges.

Identify irreplaceable wetlands

This list of significant wetland sites identifies resources that are essentially irreplaceable. Some A-ranked and B-ranked sites contain wetland features like peatlands, spruce swamps, and rare plants which could not realistically be mitigated if lost.

Identify potential Research Natural Areas and Botanical Special Interest Areas

High ranking sites on Forest Service or Bureau of Land Management lands may be good candidates for designation as Research Natural Areas, Botanical Special Interest Areas, or Areas

of Critical Environmental Concern. Likewise, similar sites on State land could be managed to maintain significant natural values.

Identify reference wetlands

Consultants, wetland scientists, watershed groups, and government agencies can use these results to identify reference wetlands. Such sites can serve as models of wetland plant community structure/composition for comparison/evaluation of other sites, for restoration projects, or as seed sources for plant materials. Reference wetlands are also extremely useful for inferring the impacts of certain land use activities.

Identify potential mitigation sites

Some wetlands identified in this report could serve as mitigation sites to help offset losses of wetlands at other locations, in compliance with Section 404 of the Clean Water Act. At some sites, restoring hydrology by blocking peripheral drainage would improve wetland function.

Provide context for wetland permit review

This list of significant wetlands and wetland communities can help regulators ascertain the relative scarcity of a particular wetland type or community within a watershed or region, and provide perspective on the biological importance of wetlands resources that may be impacted.

Provide information for land use decisions

County planners, regulators, and others can use this list as a tool by to help inform decisions about planning, growth, and development.

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APPENDIX A. GLOBAL/STATE RANK DEFINITIONS

Heritage Program Ranks

The international network of Natural Heritage Programs employs a standardized ranking system to denote global (range-wide) and state status (NatureServe 2002). Species are assigned numeric ranks ranging from 1 (critically imperiled) to 5 (demonstrably secure), reflecting the relative degree to which they are “at-risk”. Rank definitions are given below. A number of factors are considered in assigning ranks — the number, size and distribution of known “occurrences” or populations, population trends (if known), habitat sensitivity, and threat. Factors in a species’ life history that make it especially vulnerable are also considered (e.g., dependence on a specific pollinator).

Rank Definitions

G1 S1	Critically imperiled because of extreme rarity and/or other factors making it highly vulnerable to extinction.
G2 S2	Imperiled because of rarity and/or other factors making it vulnerable to extinction.
G3 S3	Vulnerable because of rarity or restricted range and/or other factors, even though it maybe abundant at some of its locations.
G4 S4	Apparently secure, though it may be quite rare in parts of its range, especially at the periphery.
G5 S5	Demonstrably secure, though it may be quite rare in parts of its range, especially at the periphery.
GU SU	Possibly imperiled, but status uncertain; more information needed.
GA SA	Native in nearby states, but in Montana believed to be accidentally introduced, deliberately planted, or escaped from plantings.
GH SH	Historical, known only from records over 50 year ago; may be rediscovered.
GX SX	Believed to be extinct; historical records only.

Combination Ranks

G#G# or S#S# Indicates a range of uncertainty about the rarity of the species.

Subranks

T#	Rank of a subspecies or variety; appended to the species’ global rank of the full species, e.g. G4T3.
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Qualifiers

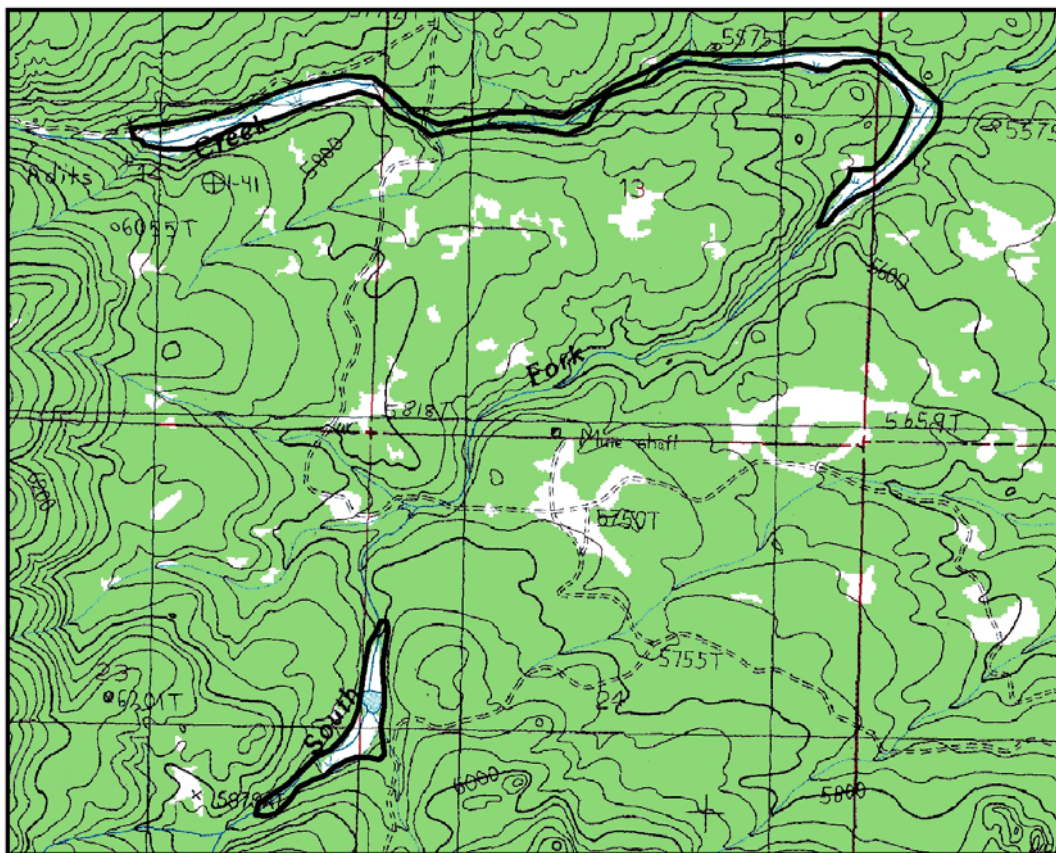
Q	Taxonomic questions or problems exist, more information needed; appended to the global rank, e.g. G3Q.
?	Denotes uncertainty or for numeric ranks, inexactness.

APPENDIX B. SITE DESCRIPTIONS

LIST OF SITES

Beaver Creek.....	1
California Slough.....	3
Curly Lake Wetland.....	6
Hay Creek	8
Headwaters	10
Leonard Creek Fen.....	13
Lombardi Meadows	15
Lost Cabin Wetlands.....	17
Lost Park	19
O’Neil Creek.....	21
Piedmont Swamp	23
Potosi Hot Spring.....	26
Red Rock Fen.....	28
Red Rock Lakes	30
Red Rock Ponds.....	33
Red Rock River / Centennial Valley.....	35
Red Rock Willows	38
Table Mountain Wetlands.....	41
Three Forks	43
Upper Hells Canyon.....	44
Upper Whitetail Park	46

Beaver Creek



Directions

This site is located in the southern portion of the Boulder Batholith in southwestern Montana. From Whitehall, travel north on the Whitehall-Boulder Road for approximately 16 miles to Forest Route 637. Turn west onto this road and travel about 4.5 miles. One portion of the site lies upstream of where the road crosses Beaver Creek. The other two portions lie at the confluence of the mainstem and South Fork of Beaver Creek and approximately 2 miles upstream of the confluence along the South Fork.

Description

This site is a series of beaver-influenced willow bottoms and wet meadows along the mainstem and South Fork of Beaver Creek. These shrub and sedge-dominated openings occur as discontinuous patches along low gradient stream segments. Old beaver dams have created small and medium-sized ponded areas that are scattered throughout these openings. Soils are variable, ranging from coarse and loamy sand to silty and silty clay loam. Most communities have a histic epipedon of peat or mucky peat ranging from 5 to 12 cm thick.

Tall willow and alder communities occupy most of the site. Dominant shrubs include *Salix boothii* (Booth's Willow), *Salix geeyeriana* (Geyer's Willow), *Salix drummondiana* (Drummond's Willow), and *Alnus incana* (Mountain Alder). Understory dominants are *Carex utriculata* (Beaked Sedge) in wetter areas and *Calamagrostis canadensis* (Bluejoint Reedgrass) in less mesic locations. Other common species include *Rubus idaeus* (Common Red Raspberry), *Poa pratensis* (Kentucky Bluegrass), *Carex canescens* (Hoary Sedge), *Geum macrophyllum* (Large-Leaf Avens), *Galium triflorum* (Fragrant Bedstraw), *Equisetum pratense* (Meadow Horsetail), *Urtica dioica* (Stinging Nettle), and

Thalictrum venulosum (Veiny-Leaf Meadow-Rue). *Carex utriculata* communities occupy wetter substrates around pond margins. In some locations, failure of beaver dams has lowered the water table and led to the drying out of these sedge meadows.

Key Environmental Factors

Past beaver activity has played an important role in creating wetter conditions at this site. Beaver dams have increased the habitat diversity and complexity of these wetlands by creating open water areas and sedge meadows along silted-in pond margins.

Rarity

No rare species or communities were documented at this site. However, several common willow communities occur in good condition.

Land Use

Much of this site receives heavy browsing pressure by cattle as well as wild ungulates (deer and moose). Some wetter substrates around pond margins have been greatly disturbed by hoof shear.

Exotics

Three exotic species, *Poa pratensis* (Kentucky Bluegrass), *Cirsium arvense* (Canadian Thistle), and *Taraxacum officinale* (Common Dandelion), were documented at the site. All three were restricted to drier microsites and were most common in the *Salix boothii* / *Calamagrostis canadensis* (Booth's Willow / Bluejoint Reedgrass) community.

Uplands

Uplands are intact native forest. Livestock grazing has caused some impacts. Mining, mostly in the form of placer mining, has been widespread in the Beaver Creek drainage. The Attowa, Beaver Placer, and Ajax mines are located on or near Beaver Creek upstream from the site.

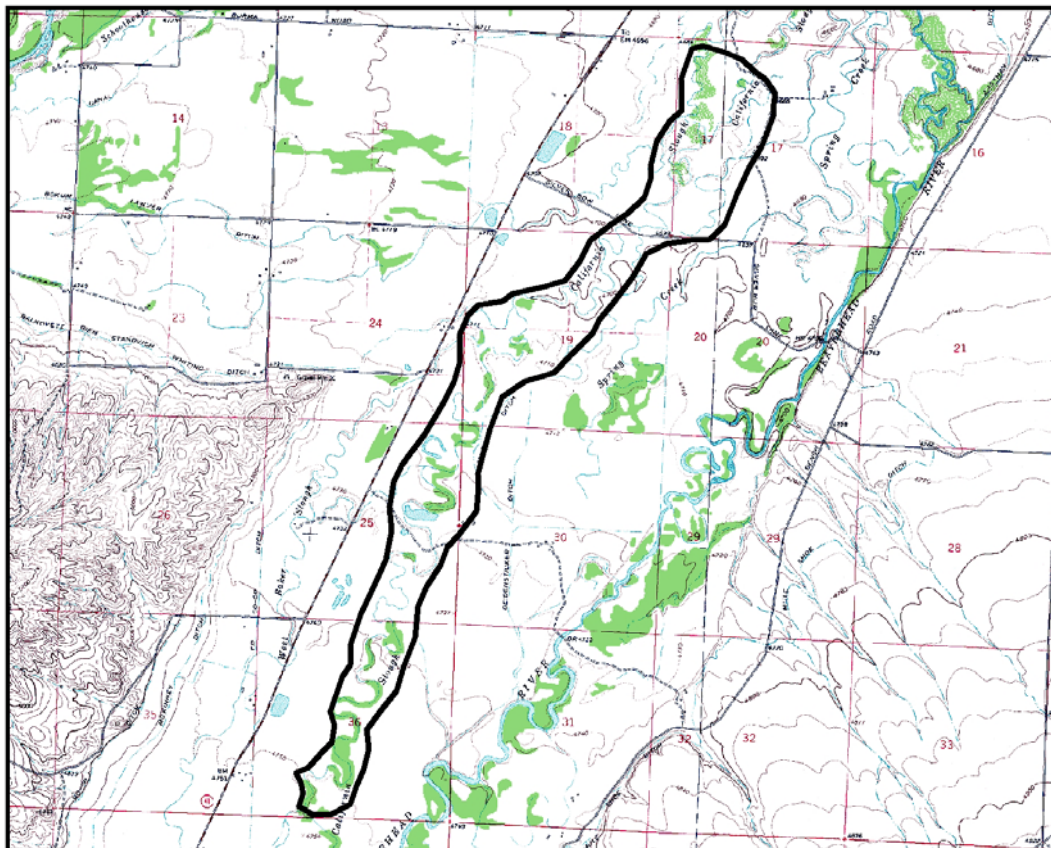
Information Needs

Has mining affected the hydrology or water and soil chemistry at this site?

Plant Community Information

Plant Association / Dominance Type	Rarity Ranks		Viability Rank	EO? (Y/N)
	State	Global		
<i>Carex utriculata</i> Herbaceous Vegetation	S5	G5	B	N
<i>Salix boothii</i> / <i>Calamagrostis canadensis</i> Shrubland	S3	G3G4Q	B	Y
<i>Salix boothii</i> / <i>Carex utriculata</i> Shrubland	S4	G4	B	N
<i>Salix drummondiana</i> / <i>Carex utriculata</i> Shrubland	S4	G4	A	Y
<i>Salix geyeriana</i> / <i>Carex utriculata</i> Shrubland	S5	G5	B	N

California Slough



Directions

Note: this site is located on private land, and landowner permission is required to access this site. California Slough lies in the valley bottom of the Beaverhead River near its confluence with the Ruby and Big Hole Rivers. Travel southwest from Twin Bridges on State Route 41 for 5.25 miles. Turn west on Silver Bow Lane and travel approximately 0.5 mile. The site lies along California Slough.

Description

These wetlands occur along California Slough and other distributaries of the Beaverhead River. California Slough is augmented with irrigation flows. Soils are 30 to 40 cm of peat, marly peat, and silty clay loam overlying gravel and gravelly sandy clay loam.

The California Slough floodplain is a mosaic of saturated marly flats interspersed with tussocks dominated by a *Carex simulata* (Short-Beaked Sedge) community. The flats are sparsely vegetated with *Eleocharis quinqueflora* (Few-Flowered Spikerush) and *Triglochin maritima* (Seaside Arrow-Grass). Lower areas support a shallow aquatic community dominated by *Ceratophyllum demersum* (Coon's-Tail). The *Carex simulata*-dominated tussocks are very species rich. The moss *Campyllum stellatum* forms a near continuous cover; common vascular species include *Juncus balticus* (Baltic Rush), *Carex aquatilis* (Water Sedge), *Schoenoplectus acutus* (Hard-Stem Bulrush), *Agrostis stolonifera* (Redtop), *Muhlenbergia richardsonis* (Mat Muhly), *Calamagrostis stricta* ssp. *stricta* (Slim-Stem Reedgrass), *Juncus torreyi* (Torrey's Rush), *Elymus trachycaulus* (Slender Wildrye), *Crepis runcinata* (Meadow Hawk's-Beard), *Parnassia palustris* (Marsh Grass-of-Parnassus), *Lycopus asper* (Rough Water-Horehound), *Triglochin*

palustris (Marsh Arrow-Grass), *Symphotrichum ericoides* var. *pansum* (White Heath Aster), and *Gentianella amarella* (Northern Gentian). Three shrub species are also present: *Salix candida* (Hoary Willow), *Salix planifolia* (Planeleaf Willow), and *Shepherdia argentea* (Silver Buffalo-Berry). All are well browsed and less than 10 cm in height. Without browsing pressure, this community might be classified as a *Salix candida* type in places. *Carex simulata* communities also occur in smaller swales adjacent to California Slough. These swales are extremely hummocked in places, probably from livestock grazing.

Other plant communities present include *Schoenoplectus acutus*, *Typha latifolia* (Broadleaf Cattail), and an aquatic community dominated by *Sagittaria cuneata* (Arum-Leaf Arrowhead), *Hippuris vulgaris* (Common Mare's-Tail), and *Glyceria striata* (Fowl Manna Grass). The *Typha latifolia* community is common in semipermanently flooded areas along California Slough; however, in some areas it appears to be invading the *Carex simulata* community on the floodplain. A *Shepherdia argentea* (Silver Buffalo-Berry) shrubland occupies the terrace adjacent to the slough and swales. *Sporobolus airoides* (Alkali-Sacaton) is a common herbaceous dominant, although the native weedy species *Iva axillaris* (Poverty Weed) occupies large areas.

Key Environmental Factors

Surface water flooding and high groundwater tables sustain these mesic-hydric habitats. The hydrologic regime along California Slough has been stable and wet enough for peat to accumulate; the depth of the peat layer implies that the current hydrologic regime predates historic irrigation practices.

Rarity

This site supports large populations of three rare plants: *Spiranthes diluvialis* (Ute Ladies'-Tresses; S2 / G2, federally listed threatened), *Castilleja minor* ssp. *minor* (= *Castilleja exilis*, Alkali Indian-Paintbrush; S2 / G5), and *Primula incana* (Mealy Primrose; S2 / G4G5). All three species are locally common at the site.

Land Use

The site is grazed by livestock (horse and cattle), and, in places, livestock have created severe hummocking in more mesic swales. This site is also used for hunting and is part of a block management area.

Exotics

There are few exotic species at this site. *Agrostis stolonifera* (Redtop) is common throughout and *Euphorbia esula* (Leafy Spurge) is beginning to colonize the southern portion of the site.

Uplands

The surrounding uplands are intensively used for rangeland and some cropland.

Information Needs

How do irrigation inflows into California Slough affect the site's hydrology? Cattails at the site were identified as *Typha latifolia* (Broadleaf Cattail). They should be examined again to make certain they are not the hybrid *Typha × glauca*, which can be a much more aggressive colonizer and might invade the *Carex simulata* (Short-Beaked Sedge) community and affect the rare plant species that it supports.

Management Needs

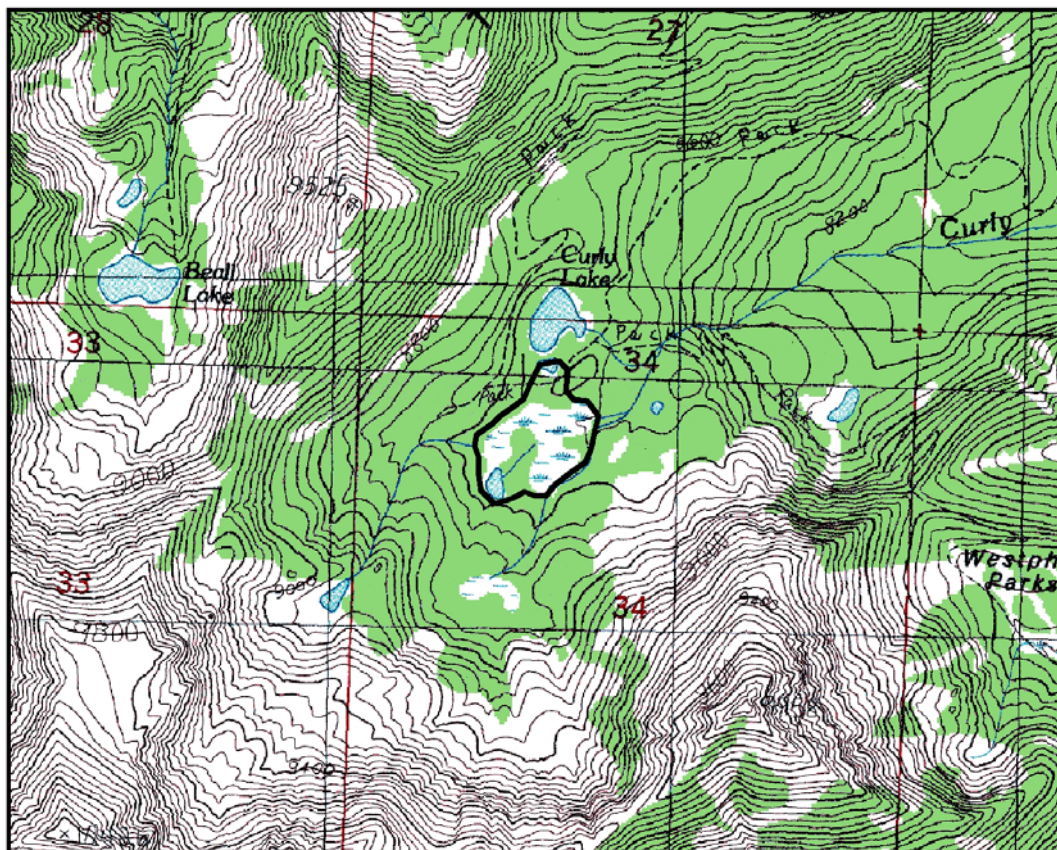
Currently, *Euphorbia esula* (Leafy Spurge) is restricted to the State lands section where it is being diligently treated by the leasee.

Plant Community Information

Plant Association / Dominance Type	Rarity Ranks		Viability Rank	EO? (Y/N)
	State	Global		
<i>Carex simulata</i> Herbaceous Vegetation	S3	G4	B	Y
<i>Carex simulata</i> Herbaceous Vegetation	S3	G4	C	N
<i>Schoenoplectus acutus</i> Herbaceous Vegetation	S5	G5	*	N
<i>Shepherdia argentea</i> Shrubland	S3?	G3G4	C	N
<i>Typha latifolia</i> Western Herbaceous Vegetation	S5	G5	*	N
Rare Plants				
<i>Castilleja minor</i> ssp. <i>minor</i>	S2	G5	*	Y
<i>Primula incana</i>	S2	G4G5	*	Y
<i>Spiranthes diluvialis</i>	S2	G2	*	Y

* Rank not assigned

Curly Lake Wetland



Directions

This site is located in the Tobacco Root Mountains of southwestern Montana. From Cardwell, travel approximately 5 miles south on State Route 359. Turn west onto the Boulder River Road (Forest Route 107) and travel for about 16 miles to the Westphal Parks trailhead. The wetlands are approximately 2.5 miles up the trail.

Description

This subalpine wetland occurs in a shallow glacial depression at the headwaters of Curly Creek. This wetland receives both surface flows from the creek and groundwater discharge. Soils throughout much of the site are saturated and peaty. Most of the site is dominated by a *Carex aquatilis* (Water Sedge) community. Although *Carex aquatilis* is dominant throughout, associated species vary with microtopography. Wet swales support *Eleocharis quinqueflora* (Few-Flower Spikerush), *Carex utriculata* (Beaked Sedge), *Eriophorum angustifolium* (Tall Cotton-Grass), *Caltha leptosepala* (White Marsh-Marigold), and *Parnassia fimbriata* (Fringed Grass-of-Parnassus). Swales also have greater cover of mosses, such as *Tomentypnum nitens*, *Aulacomnium palustre*, and *Scorpidium revolvens*. Drier hummocks support *Deschampsia caespitosa* (Tufted Hair Grass), *Calamagrostis canadensis* (Bluejoint Reedgrass), *Camassia quamash* (Camas), *Pedicularis groenlandica* (Elephant's-Head), and *Allium schoenoprasum* (Wild Chives). *Carex utriculata* dominates wetter areas fringing open water.

Key Environmental Factors

Saturated soil conditions and the subsequent peat development are primary factors that affect the composition and functioning of this site. The geochemistry of the surrounding bedrock is another important influence. The gneiss and schist that underlie the site provide relatively nutrient poor groundwater. Nutrient status and pH of groundwater can greatly influence the species composition of wetlands, especially in fens.

Rarity

Fens are a very rare wetland type in Montana, especially in the southwestern portion of the site, and have a high conservation value.

Other Values

Western Chorus Frog (*Pseudacris triseriata*) was documented at this site.

Land Use

This site receives little apparent human use. The adjacent Curly Lake receives high recreational use.

Exotics

No exotic species were documented at the site.

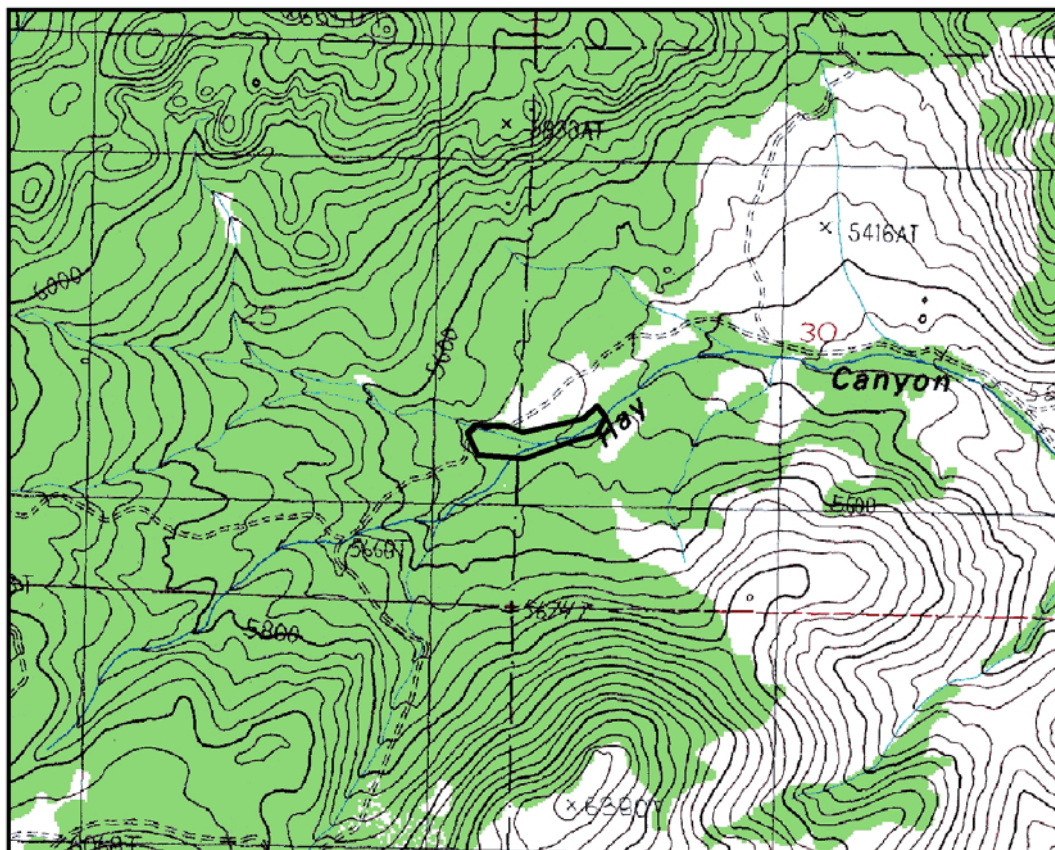
Uplands

The surrounding uplands are undisturbed.

Plant Community Information

Plant Association / Dominance Type	Rarity Ranks		Viability Rank	EO? (Y/N)
	State	Global		
<i>Carex aquatilis</i> Herbaceous Vegetation	S4	G5	A	Y
<i>Carex utriculata</i> Herbaceous Vegetation	S5	G5	A	N

Hay Creek



Directions

This site is located in the southern portion of the Boulder Batholith in southwestern Montana. From Whitehall, travel north on the Whitehall-Boulder Road for approximately 13 miles to Forest Route 8598. Turn west onto this road (toward Hay Canyon) and travel about 4 miles. The site lies at the Forest Service/BLM property boundary near the intersection of Forest Routes 8598 and 637.

Description

This site lies at the confluence of Hay Creek and a small tributary. Portions of this site are very wet, either because of increased surface flow or groundwater discharge. These wetter areas are underlain by histic soils and support highly mesic plant species. Vegetation in these areas is characterized by a high cover of mesic shrubs, including *Cornus sericea* (Red-Osier Dogwood), *Betula occidentalis* (Water Birch), *Salix bebbiana* (Bebb Willow), and *Alnus incana* (Mountain Alder), over a dense sward of *Carex utriculata* (Beaked Sedge). Other common species include *Carex aquatilis* (Water Sedge), *Carex interior* (Inland Sedge), *Equisetum arvense* (Field Horsetail), *Geum macrophyllum* (Large-Leaf Avens), *Maianthemum stellatum* (Starry False Solomon's-Seal), *Viola nephrophylla* (Northern Bog Violet), and the moss *Plagiomnium rugicum*. Downstream from this area, the channel becomes incised and vegetation is characterized by a closed canopy of pole-sized *Populus tremuloides* (Quaking Aspen). The shrub layer is largely nonexistent and the herbaceous layer is dominated by the pasture grasses *Poa pratensis* (Kentucky Bluegrass) and *Agrostis stolonifera* (Redtop).

Key Environmental Factors

Hydrological inputs from surface and groundwater maintain the mesic character of this site. Channel incision, possibly due to livestock grazing, has altered bank morphology and stream access to the floodplain, making portions of the site drier.

Rarity

One G3 community, *Betula occidentalis* / Mesic Graminoids (Water Birch / Mesic Graminoids), was documented in good condition.

Land Use

The portion of the site on Forest Service land shows little evidence of livestock browsing. More palatable shrubs, such as *Cornus sericea* (Red-osier Dogwood), are moderately browsed, probably by wild ungulates. In contrast, the portion of the site on BLM land receives greater browsing pressure, which contributes increased bank erosion, significantly pugged soils, and high cover of exotics characteristic of this area.

Exotics

Cirsium arvense (Canadian Thistle), *Poa pratensis* (Kentucky Bluegrass), and *Agrostis stolonifera* (Redtop) are common exotic species. All occur in the heavily grazed *Populus tremuloides* / *Poa pratensis* (Quaking Aspen / Kentucky Bluegrass) community.

Uplands

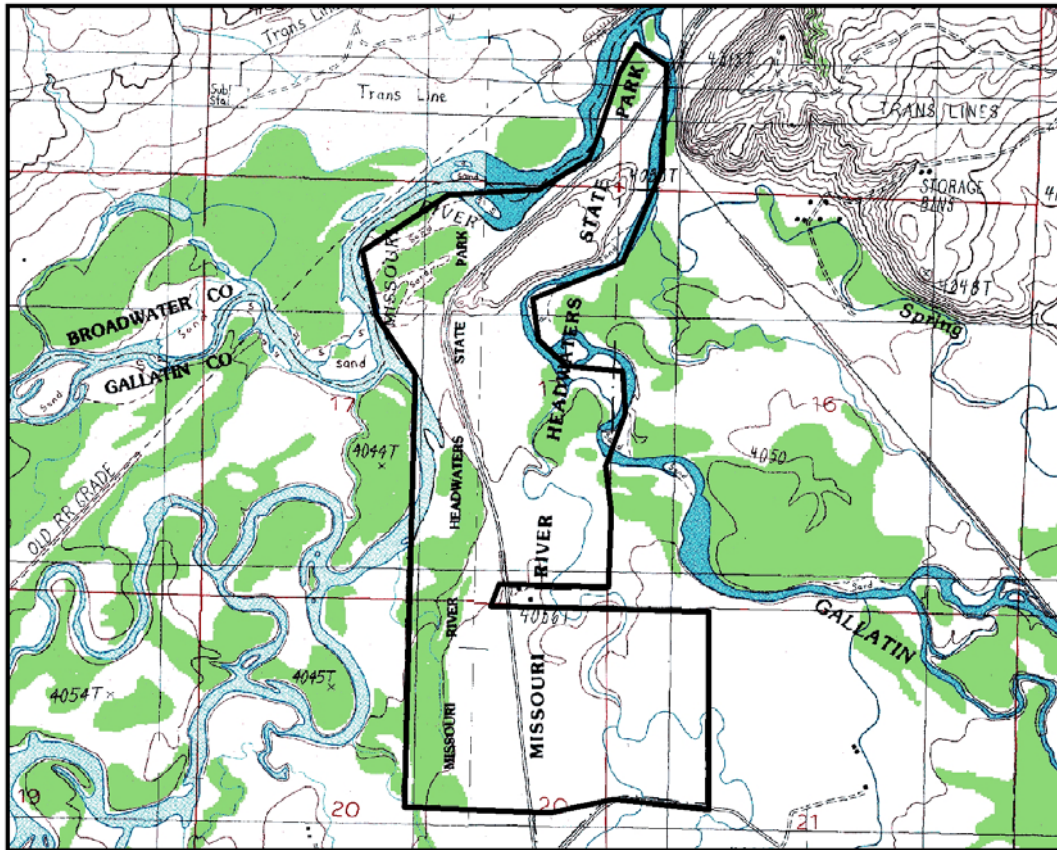
Uplands are intact native range and forest, although there are some impacts due to livestock grazing.

Plant Community Information

Plant Association / Dominance Type	Rarity Ranks		Viability Rank	EO? (Y/N)
	State	Global		
<i>Populus tremuloides</i> / <i>Poa pratensis</i> Dominance Type	S?	*	C	N
<i>Salix bebbiana</i> Shrubland	S3?	G3?	B	Y

* Rank not assigned

Headwaters



Directions

This site lies at the confluence of the Gallatin, Jefferson, and Madison Rivers. The site is 4 miles northeast of the town of Three Forks, and can be accessed via Highways 205 and 286.

Description

This site occurs along river terraces and floodplains at the confluence of the Madison, Gallatin, and Jefferson Rivers. This area is characterized by meandering swales and sloughs, shrub thickets, and riparian forests. The southeastern portion of the site consists of several sloughs. These sloughs are seasonally flooded and have up to 30 cm of peat substrate over cobbles. These areas support *Carex simulata* (Short-Beaked Sedge) communities. Although dominated by *Carex simulata*, several other species are well represented to abundant in these communities, including *Carex aquatilis* (Water Sedge), *Juncus balticus* (Baltic Rush), and *Schoenoplectus pungens* (Three-Square). Adjacent semipermanently flooded areas are dominated by *Typha latifolia* (Broadleaf Cattail) with *Hippuris vulgaris* (Common Mare's-Tail) and *Eleocharis palustris* (Common Spikerush). Many of these sloughs have natural levees that support linear communities dominated by *Shepherdia argentea* (Silver Buffaloberry), *Symphoricarpos occidentalis* (Western Snowberry), *Rosa woodsii* (Woods' Rose), *Lonicera tatarica* (Twinsisters), and *Maianthemum stellatum* (Starry False Solomon's-Seal). Terraces adjacent to these sloughs mostly consist of a weedy community co-dominated by *Juncus balticus* and *Poa pratensis* (Kentucky Bluegrass). Other common species include *Carex praegracilis* (Clustered Field Sedge), *Pascopyrum smithii* (Western Wheatgrass), *Iris missouriensis* (Rocky Mountain Iris), and *Achillea*

millefolium (Common Yarrow). Where sampled, soils on this landform were clay loam and clay. Higher terrace deposits are more sparsely vegetated. They support saline and alkali-tolerant species such as *Sarcobatus vermiculatus* (Greasewood), *Distichlis spicata* (Saltgrass), *Sporobolus airoides* (Alkali-Sacaton), and *Opuntia polyacantha* (Hair-Spine Prickly-Pear). *Distichlis spicata* is the dominant species, although *Sarcobatus vermiculatus* becomes abundant enough in places to form a shrub-herbaceous community.

Willow and birch communities dominate the western portion of the site along the East Fork Madison River and associated sloughs. The vegetation is a mosaic of mesic to hygric shrub communities, including *Salix lutea* / *Juncus balticus* (Yellow Willow / Baltic Rush), *Salix bebbiana* (Bebb Willow), and *Salix lutea* / *Carex utriculata* (Yellow Willow / Beaked Sedge). *Salix lutea*, *Salix bebbiana*, and *Betula occidentalis* (Water Birch) are the dominant shrubs; other common shrubs are *Symphoricarpos occidentalis*, *Shepherdia argentea*, *Rosa woodsii*, and *Rosa acicularis* (Prickly Rose). The wettest communities have a ground layer dominated by *Carex utriculata*, whereas mesic graminoids, such as *Juncus balticus*, *Carex praegracilis*, *Poa compressa* (Canada Bluegrass), and *Poa pratensis*, dominate drier areas. Common forbs include *Solidago gigantea* (Late Goldenrod), *Maianthemum stellatum*, *Thermopsis montana* (Montane Thermopsis), and *Lycopus asper* (Rough Water-Horehound).

This site also supports cottonwood forests, which are best developed along the Gallatin River and associated sloughs. *Populus balsamifera* ssp. *trichocarpa* / *Cornus sericea* (Black Cottonwood / Red-Osier Dogwood) and *Populus deltoides* / *Symphoricarpos occidentalis* (Plains Cottonwood / Western Snowberry) communities comprise these stands. Soils are 30 to 40 cm of silty clay loams over loamy sands and sandy loams. Stands with *Cornus sericea* are restricted to an island. Mature *Populus balsamifera* ssp. *trichocarpa* forms a closed canopy over an open shrub layer dominated by *Salix lutea*, *Rosa woodsii*, *Cornus sericea*, and *Symphoricarpos occidentalis*. The herbaceous layer is dominated by *Agrostis stolonifera* (Redtop) and other exotic grasses. The forb *Rudbeckia laciniata* (Green-Head Coneflower) is abundant in some places.

Key Environmental Factors

The hydrological regime and associated flooding is a key factor. Sloughs may be augmented by irrigation return flows.

Rarity

No rare plants or animals were documented at this site; however, several are known from adjacent areas. This site does support three rare plant communities: *Populus balsamifera* ssp. *trichocarpa* / *Cornus sericea* (Black Cottonwood / Red-Osier Dogwood) and *Populus deltoides* / *Symphoricarpos occidentalis* (Plains Cottonwood / Western Snowberry) forests, both in fair condition, and *Salix bebbiana* (Bebb Willow) shrubland, which was in good condition.

Land Use

Portions of this site receive heavy recreational use. Horse pasturing and ATV use have damaged some slough areas. The terrace at the confluence of the Madison and Jefferson Rivers appears to have been farmed or hayed in the past and is now dominated by exotic pasture grasses.

Exotics

Portions of the floodplain and early successional communities along the Jefferson and Gallatin Rivers have populations of *Phalaris arundinacea* (Reed Canary Grass) and *Euphorbia esula* (Leafy Spurge). *Bromus inermis* (Smooth Brome) and *Agropyron cristatum* (Crested Wheatgrass) dominate areas previously hayed. *Cirsium arvense* (Canada Thistle) is present at low cover in willow-dominated shrublands in the southwestern portion of the site. A slough in this area has been colonized by *Phragmites australis* (Giant Reed), although the nativity of this population was not determined.

Uplands

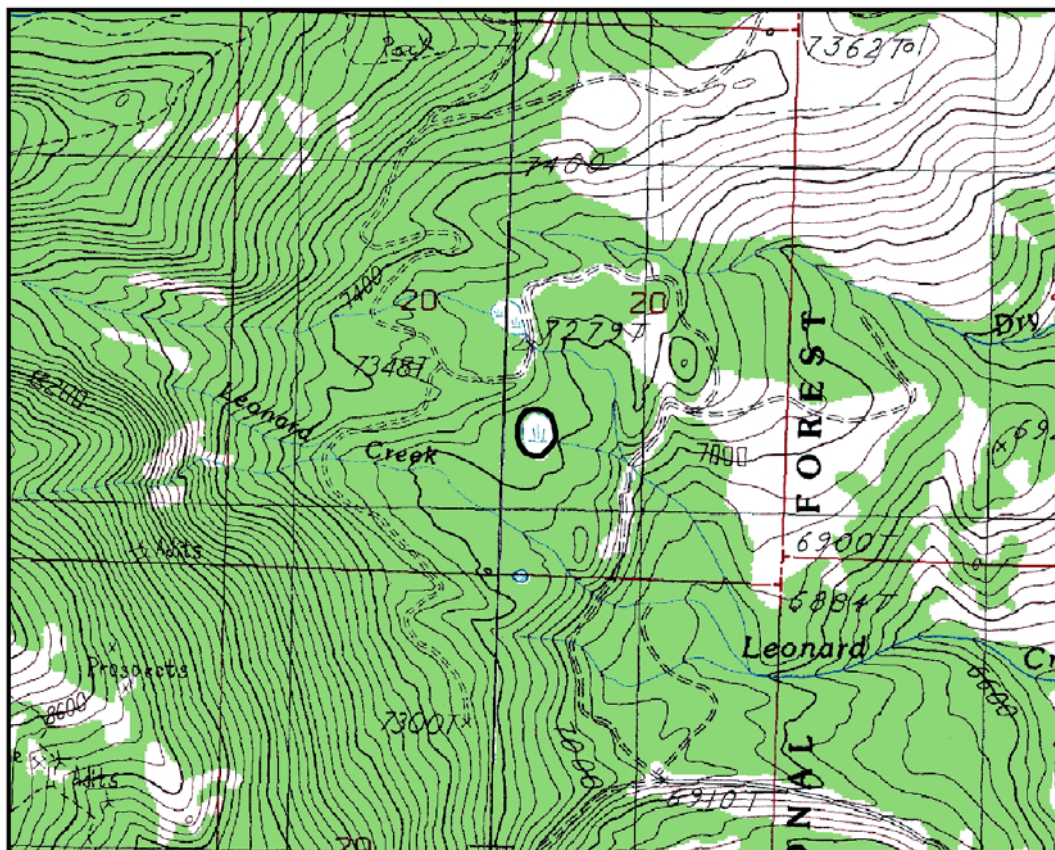
The river corridors, especially along the Jefferson River, are relatively intact. The adjacent floodplain/terrace has been extensively converted to pasture, agriculture, and residential uses.

Plant Community Information

Plant Association / Dominance Type	Rarity Ranks		Viability Rank	EO? (Y/N)
	State	Global		
<i>Carex simulata</i> Herbaceous Vegetation	S3	G4	B	Y
<i>Distichlis spicata</i> Herbaceous Vegetation	S4	G5	B	N
<i>Juncus balticus</i> Herbaceous Vegetation	S5	G5	B	N
<i>Poa pratensis</i> Semi-natural Herbaceous Alliance	SW	GW	*	N
<i>Populus balsamifera</i> ssp. <i>trichocarpa</i> / <i>Cornus sericea</i> Forest	S3?	G3?	C	Y
<i>Populus deltoides</i> / <i>Symphoricarpos occidentalis</i> Woodland	S2S3	G2G3	C	N
<i>Salix bebbiana</i> Shrubland	S3?	G3?	C	N
<i>Salix exigua</i> Temporarily Flooded Shrubland	S5	G5	C	N
<i>Salix lutea</i> / <i>Carex utriculata</i> Shrubland	S4	G4	B	N
<i>Salix lutea</i> / <i>Juncus balticus</i> Dominance Type	*	*	B	N
<i>Sarcobatus vermiculatus</i> / <i>Distichlis spicata</i> Shrubland	S2	G4	B	N

* Rank not assigned

Leonard Creek Fen



Directions

Leonard Creek Fen is located at the southern end of the Tobacco Root Mountains of southwestern Montana. The fen occurs at the head of a headwaters tributary to Leonard Creek. The town of Ennis lies 11 miles (18 km) to the southeast. From the Madison Ranger District Station drive north 7.1 miles to McAllister and Meadow Creek Road (Forest Road 1221). Travel west on Road 1221 8 miles to Forest Road 1224. Travel north on Road 1224 about one mile to a road entering on the left. Take this fork about ½ mile past a sedge meadow on the road's west side and park about 500 feet south of the meadow where the road turns to the west. Hike south-southeast approximately 500 feet to the north edge of the fen.

Description

Leonard Creek Fen is found at 7,720 feet (2201 m) in a four-acre (1.6 ha) basin supporting a floating organic mat. The primary peat-forming species, *Sphagnum magellanicum*, forms sphagnum moss lawns and small hummocks across the floating mat. Another moss, *Drepanocladus capillifolius*, is characteristic of the wet depressions. Important vascular plants include *Eleocharis quinqueflora* (Few-Flowered Spikerush) in the moss lawn and *Carex canescens* (Hoary Sedge) on hummocks. The organic mat is bordered by an open water moat on the basin's outer edge. Within the moat the common vascular species include *Menyanthes trifoliata* (Bog Bean), *Nuphar* spp. (Water- or Pond-lily), *Carex vesicaria* (Inflated Sedge), and *Utricularia minor* (Lesser Bladderwort).

The forest of the surrounding basin slopes is dominated by *Pinus contorta* (Lodgepole Pine) with scattered *Picea engelmannii* (Engelmann Spruce) and *Pinus albicaulis* (Whitebark Pine); dominance in

the undergrowth is shared by *Spiraea betulifolia* (Shiny-Leaf Spiraea) and *Juniperus communis* (Common Juniper).

Key Environmental Factors

The organic mat is able to respond to seasonal water level changes by floating, thereby maintaining a relatively constant hydrologic regime; also modulating water level changes is the mass of peat which holds a large quantity of water.

Rarity

No sensitive species have yet been described from this site.

Other Values

Though small this site is an excellent example of organic mat development in a formerly open water basin, profiling common geomorphic and plant succession processes.

Land Use

Livestock grazing occurs adjacent to the fen. Adjacent lands and the fen proper are designated as part of the suitable timber base.

Exotics

No weeds have been documented from this site.

Uplands

The timbered uplands being part of the suitable timber base are open to cutting and the hydrologic impacts of this activity can only be postulated; usually the result is to increase groundwater and runoff and thus the fen's hydrologic regime may be impacted.

Information Needs

The initial survey of this site has documented communities and their distribution or composition at a fairly superficial level; it is probable that a complex, microscale community patterning exists at this site. A weed and rare plant survey could also be conducted on the site and immediate environs. Land use practices on the uplands, as they affect the embedded wetlands, need documentation.

Management Needs

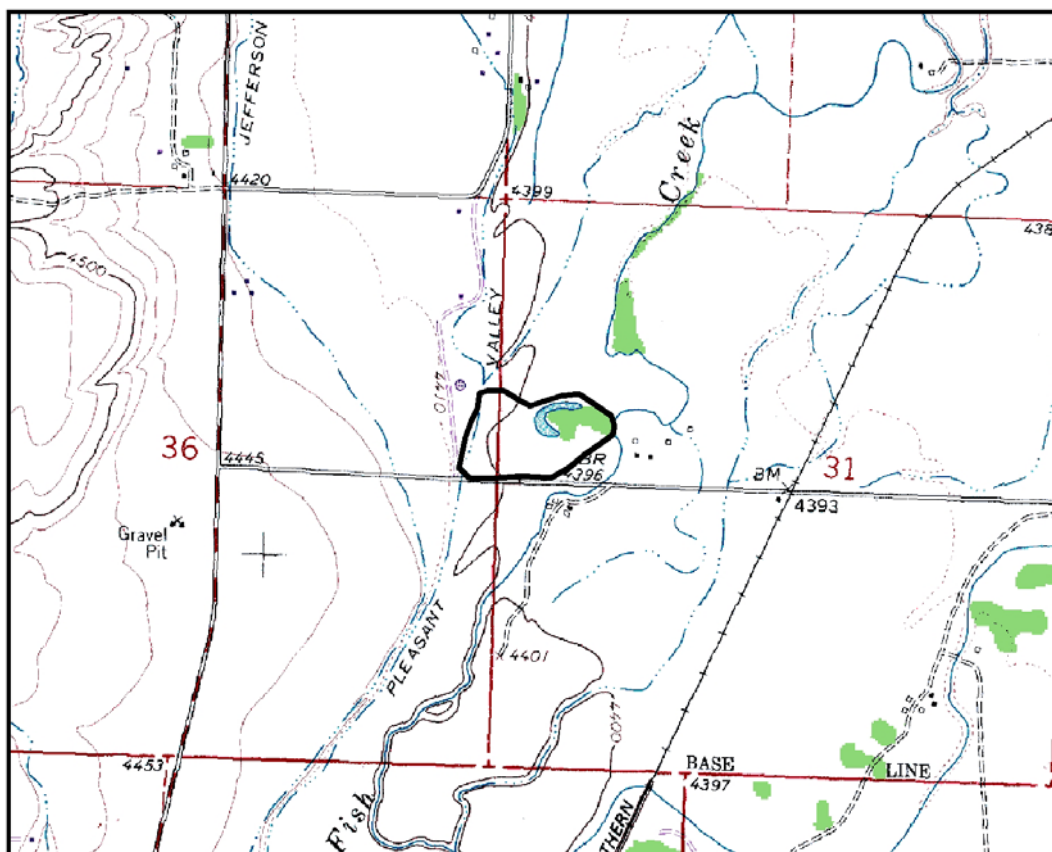
Fencing around the basin would protect the site from livestock trampling. A more complete hydrologic profile would help to resolve issues of appropriate buffers and management practices were logging to occur in this drainage.

Plant Community Information

Plant Association / Dominance Type	Rarity Ranks		Viability Rank	EO? (Y/N)
	State	Global		
<i>Sphagnum</i> spp. Alliance		*		N

* Rank not assigned

Lombardi Meadows



Directions

Note: this site is located on private land, and landowner permission is required to access this site. This wetland is located in the valley bottom of the Jefferson River adjacent to Fish Creek. From Whitehall, travel southwest on State Route 55 for approximately 6 miles. The site lies to the east along Fish Creek.

Description

This site includes an oxbow associated with Fish Creek and adjacent seep-fed meadows. The hydrology has been significantly altered by past and current irrigation practices. There are numerous small ditches and drains. The site at one time was inundated with irrigation flows from a now unused ditch. Soils in seepy areas are 12 to 16 cm of peat underlain by black clay loam and clay.

Seepy areas support three plant communities. *Typha latifolia* (Broad-Leaf Cattail) with inclusions of *Schoenoplectus acutus* (Hard-Stem Bulrush) occupies the wettest substrates. Somewhat higher locations support *Carex nebrascensis* (Nebraska Sedge) and *Carex simulata* (Short-Beaked Sedge) communities. *Schoenoplectus pungens* (Three-Square), *Crepis runcinata* (Meadow Hawk's-Beard), *Lycopus asper* (Rough Water-Horehound), and *Triglochin maritima* (Seaside Arrow-Grass) are common species in the *Carex nebrascensis* community; common associates in the *Carex simulata* community include *Eleocharis quinqueflora* (Few-Flowered Spikerush), *Muhlenbergia richardsonis* (Mat Muhly), and *Glaux maritima* (Sea-Milkwort). Adjacent wet meadows are dominated by *Juncus balticus* (Baltic Rush) and *Agrostis stolonifera* (Redtop). These areas tend to be weedy.

Key Environmental Factors

Groundwater discharge and elevated groundwater associated with Fish Creek sustain this wetland. It is unclear, however, what role irrigation seepage has played in altering the hydrology of this site.

Rarity

This site supports populations of two rare plants: *Spiranthes diluvialis* (Ute Ladies'-Tresses; S2 / G2, federally listed threatened) and *Primula incana* (Mealy Primrose; S2 / G4G5). Both species are locally common to abundant at the site. *Spiranthes diluvialis* is associated with seepy areas and wet meadows at the site.

Land Use

The landowner noted that the ditch to the west of the site formerly inundated much of the habitat when it was in use.

Exotics

Exotics are common to abundant in the uplands and in the less mesic wet meadows. Species include *Agrostis stolonifera* (Redtop), *Centaurea biebersteinii* (Spotted Knapweed), *Euphorbia esula* (Leafy Spurge), *Melilotus officinalis* (Yellow Sweet-Clover), and *Trifolium repens* (White Clover).

Uplands

This site is bordered by intensively used rangelands and croplands.

Information Needs

To what extent do irrigation flows augment these seep-fed wetlands?

Management Needs

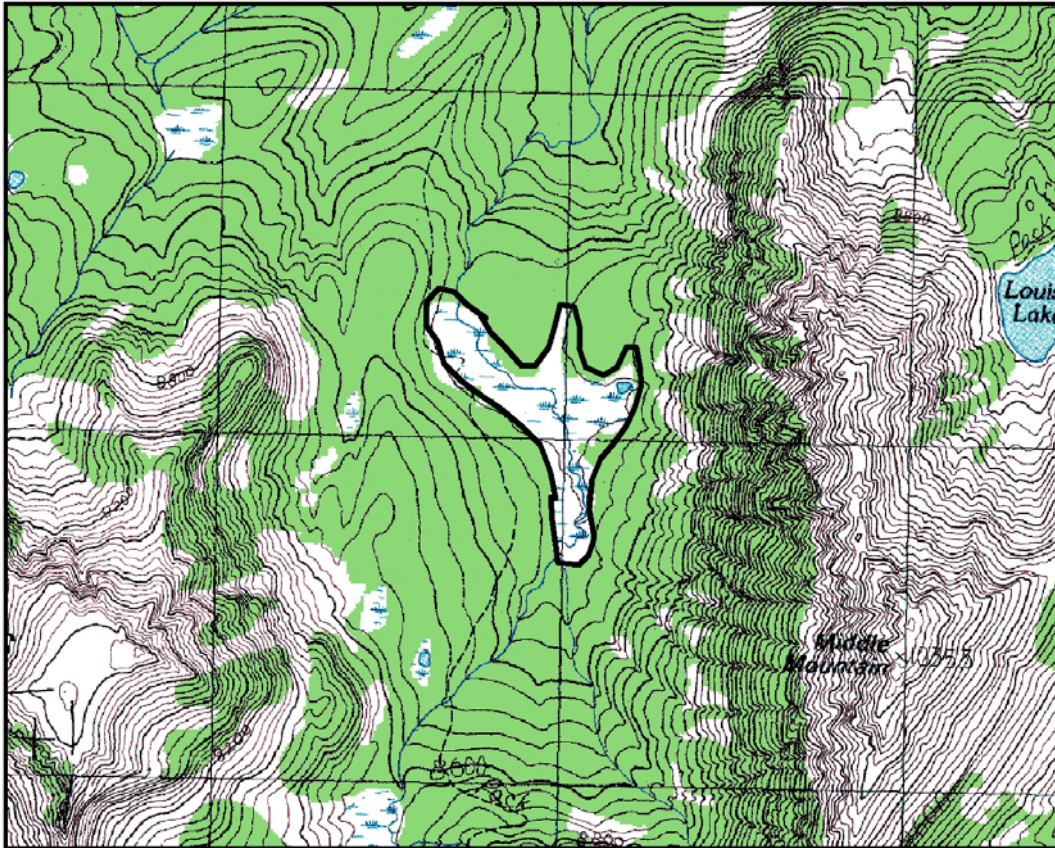
The abundance of exotic species is of concern and could be addressed with a weed control plan.

Plant Community Information

Plant Association / Dominance Type	Rarity Ranks		Viability Rank	EO? (Y/N)
	State	Global		
<i>Carex nebrascensis</i> Herbaceous Vegetation	S4	G4	C	N
<i>Carex simulata</i> Herbaceous Vegetation	S3	G4	C	N
<i>Juncus balticus</i> Herbaceous Vegetation	S5	G5	*	N
<i>Typha latifolia</i> Western Herbaceous Vegetation	S5	G5	*	N
Rare Plants				
<i>Primula incana</i>	S2	G4G5	*	Y
<i>Spiranthes diluvialis</i>	S2	G2	*	Y

* Rank not assigned

Lost Cabin Wetlands



Directions

This site is located in the Tobacco Root Mountains of southwestern Montana. From Cardwell, travel approximately 5 miles south on State Route 359. Turn west onto the Boulder River Road (Forest Route 107) and travel for about 15.5 miles to the Lost Cabin Lake trailhead. The Lost Cabin wetlands are located approximately 2 miles up the trail.

Description

This site consists of subalpine wet meadows and sedge fens along a small tributary of the South Boulder River. The wetland occurs in the stream's floodplain and along the adjacent toeslope where numerous seeps and springs maintain saturated soil conditions for much of the site. These saturated areas have a well-developed peat layer ranging from 60 to over 120 cm deep and support sedge-dominated fen communities, such as *Carex aquatilis* (Water Sedge), *Carex scopulorum* (Holm's Rocky Mountain Sedge), and *Carex utriculata* (Beaked Sedge). *Carex utriculata* occupies the wettest areas and tends to form monotypic stands. The *Carex aquatilis* and *Carex scopulorum* communities are more species rich; common to well represented species include *Eleocharis quinqueflora* (Few-Flowered Spikerush), *Deschampsia caespitosa* (Tufted Hair Grass), *Carex praeceptorium* (Teacher's Sedge), *Caltha leptosepala* (White Marsh-Marigold), and *Packera streptanthifolia* (Rocky Mountain Groundsel). The shrubs *Salix planifolia* (Planeleaf Willow) and *Kalmia microphylla* (Alpine-Laurel) occur at very low cover. These communities also support a dense cover of brown mosses, the most common being *Tomentypnum nitens*, *Aulacomnium palustre*, *Scorpidium revolvens*, and *Plagiomnium rugicum*.

Sphagnum warnstorffii is abundant in very localized patches in the northern portion of the site. The liverwort *Cephalozia leucantha* also occurs at the site.

The site also supports drier wet meadows, both on the toeslope and along natural levees adjacent to the creek channel. A *Deschampsia caespitosa* community with *Phleum alpinum* (Mountain Timothy) dominates the drier portions of the toeslope, while *Calamagrostis canadensis* (Bluejoint Reedgrass) occupies portions of the creek banks. Small patches of *Picea engelmannii* (Engelmann Spruce) and *Abies lasiocarpa* (Subalpine Fir) with a sparse understory of *Vaccinium scoparium* (Grouse Whortleberry) occur in narrow bands in areas with higher microtopography. The uplands consist of similar forests.

Key Environmental Factors

Saturated soil conditions and subsequent peat development are primary factors that affect the composition and functioning of this site. The geochemistry of the surrounding bedrock is another important influence. The gneiss and schist that underlie the site provide relatively nutrient poor groundwater. Nutrient status and pH of groundwater can greatly influence the species composition of wetlands, especially in fens.

Rarity

This wetland supports a stable population of *Selaginella selaginoides* (Low Spike-Moss; S2 / G5). Fens are a very rare wetland type in Montana, especially in the southwestern portion of the site, and have a high conservation value.

Other Values

Both Western Chorus Frog (*Pseudacris triseriata*) and Spotted Frog (*Rana luteiventris*) were documented at this site.

Land Use

Human use of the area is largely recreational and a popular hiking trail skirts the edge of the wetland. Cattle grazing is permitted in the area although no evidence of grazing was observed at the site.

Exotic

No exotic species were documented.

Uplands

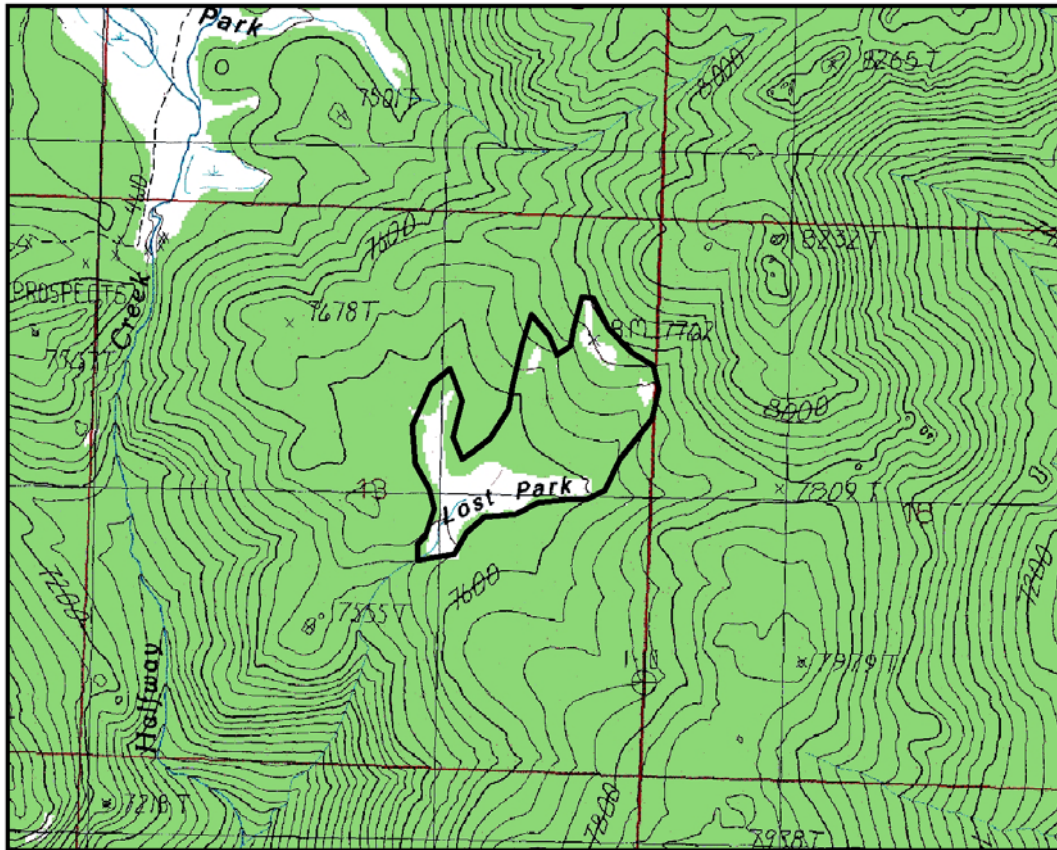
The surrounding uplands are undisturbed.

Plant Community Information

Plant Association / Dominance Type	Rarity Ranks		Viability Rank	EO? (Y/N)
	State	Global		
<i>Carex aquatilis</i> Herbaceous Vegetation	S4	G5	A	Y
<i>Carex scopulorum</i> Herbaceous Vegetation	S4	G5	A	Y
<i>Carex utriculata</i> Herbaceous Vegetation	S5	G5	A	N
Rare Plants				
<i>Selaginella selaginoides</i>	S2	G5	*	Y

* Rank not assigned

Lost Park



Directions

Lost Park RNA is located in the eastern portion of the Beaverhead-Deerlodge National Forest, 11 miles (18 km) northeast of Butte, Montana, on the east side of the Continental Divide. The RNA is drained by an unnamed tributary of Halfway Creek, which flows into Pipestone Creek.

Description

Lost Park Research Natural Area encompasses a group of subalpine wetlands (average elevation 7600 feet [2303 m]) collectively named "Lost Park". The wetlands feature wet willow communities dominated by the willows *Salix geyeriana* (Geyer's Willow), *Salix planifolia* (Planeleaf Willow), and *Salix wolfii* (Wolf Willow) over an herbaceous layer dominated by *Carex aquatilis* (Water Sedge) and *Carex utriculata* (Beaked Sedge). This wetland area totals about 70 acres (28 ha). Surrounding forests are largely dominated by *Pinus contorta* (Lodgepole Pine) and *Abies lasiocarpa* (Subalpine Fir). Three subalpine fir forest habitat types have been identified within the RNA: *Abies lasiocarpa* / *Calamagrostis canadensis* (Subalpine Fir / Bluejoint Reedgrass), *Abies lasiocarpa* / *Calamagrostis rubescens* (Subalpine Fir / Pinegrass), and *Abies lasiocarpa* / *Vaccinium scoparium* (Subalpine Fir / Grouse Whortleberry). A 25-acre (11 ha) meadow classified as the *Festuca idahoensis* – *Pseudoroegneria spicata* (Idaho fescue – Bluebunch Wheatgrass) habitat type is also present. The site is underlain by the Boulder Batholith, a large granitic formation of west-central Montana. Outcrops of this highly erodible material occur along upper elevation ridgelines. Elevations within the RNA range from a low of 6800 feet (2073 m) where the

stream leaves the RNA on the south, to a high of 8206 feet (2501 m) at a summit on the northeast boundary.

Key Environmental Factors

A high groundwater table has created the saturated conditions that have led to the development of the wetland communities at this site.

Rarity

No rare plants, animals, or communities were documented at this site.

Land Use

Little human use occurs within this Research Natural Area.

Exotics

No exotic species were documented at the site.

Uplands

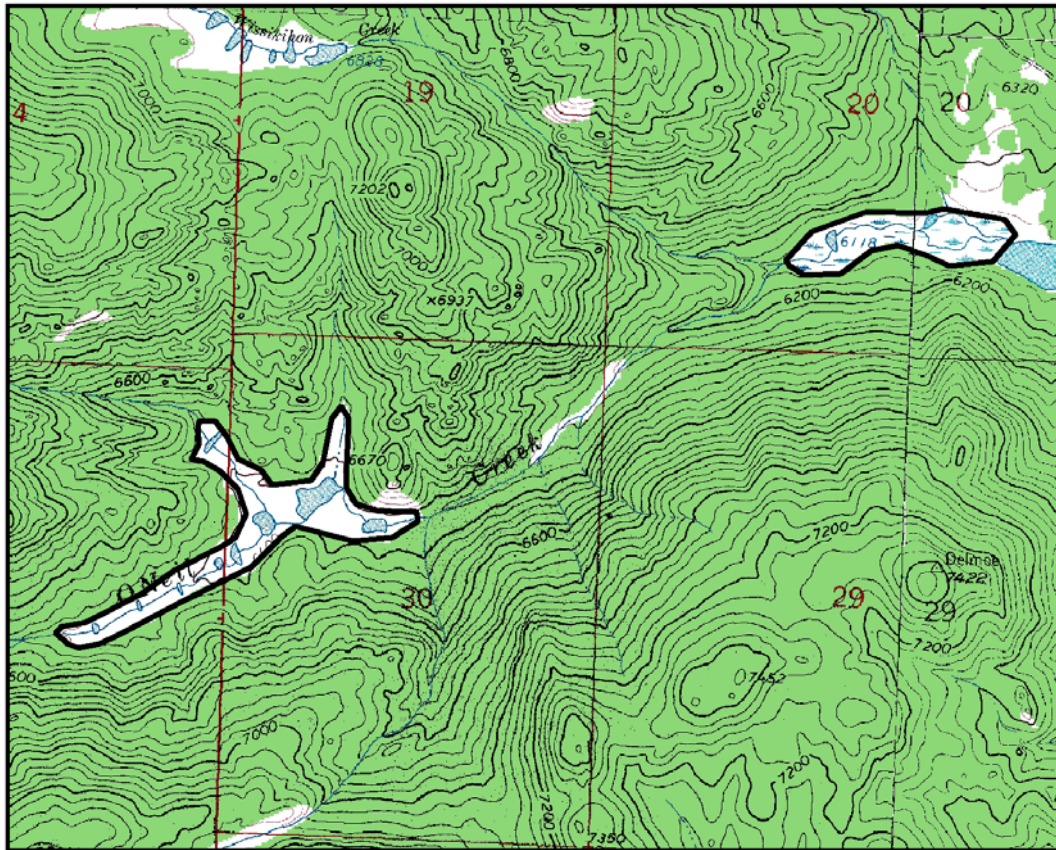
Surrounding uplands receive little management activities, although motorized offroad use is increasing in the area.

Plant Community Information

Plant Association / Dominance Type	Rarity Ranks		Viability Rank	EO? (Y/N)
	State	Global		
<i>Salix geyeriana</i> / <i>Carex utriculata</i> Shrubland	S5	G5	*	N
<i>Salix wolfii</i> / <i>Carex aquatilis</i> Shrubland	S3	G4	*	N

* Rank not assigned

O'Neil Creek



Directions

This site lies within the Boulder Mountains of southwestern Montana. From Butte, take Interstate 90 east for about 4.5 miles to Homestake Pass. Turn north onto Forest Route 222 and travel for approximately 8.5 miles to Delmoe Lake. O'Neil Creek can be accessed by trail from the western arm of the lake.

Description

This site is a series of beaver influenced wetlands along O'Neil Creek. At the time of the inventory, beaver dams were inactive and some local channel incisement had occurred below the dams. Vegetation is characterized by an open to closed willow canopy interspersed with sedge-dominated meadows. Dominant willows are *Salix geyeriana* (Geyer's Willow), *Salix drummondiana* (Drummond's Willow), and *Salix boothii* (Booth's Willow). *Carex utriculata* (Beaked Sedge) dominates the groundlayer at wetter locations with *Calamagrostis canadensis* (Bluejoint Reedgrass) becoming dominant in drier portions. Similarly, wet sedge meadows form a near monotypic stand of *Carex utriculata*, whereas drier meadows support *Carex aquatilis* (Water Sedge), *Deschampsia caespitosa* (Tufted Hairgrass), and *Calamagrostis canadensis*, often with scattered low willows, such as *Salix planifolia* (Planeleaf Willow). In places, willows are mostly dead and are being succeeded by *Alnus incana* (Mountain Alder).

Key Environmental Factors

Past beaver activity has modified the hydrology of O'Neil Creek and created saturated conditions that led to the development of these wetlands.

Rarity

No rare plants, animals, or communities were documented.

Land Use

Browse on willows is quite high in portions of the site, primarily from moose or elk herbivory, although portions of the site are also used by domestic livestock. Browsing pressure is limiting willow regeneration and growth.

Exotics

No exotic species were documented.

Uplands

Delmoe Reservoir is a popular recreation area. Some old adits are present in the slopes near the site.

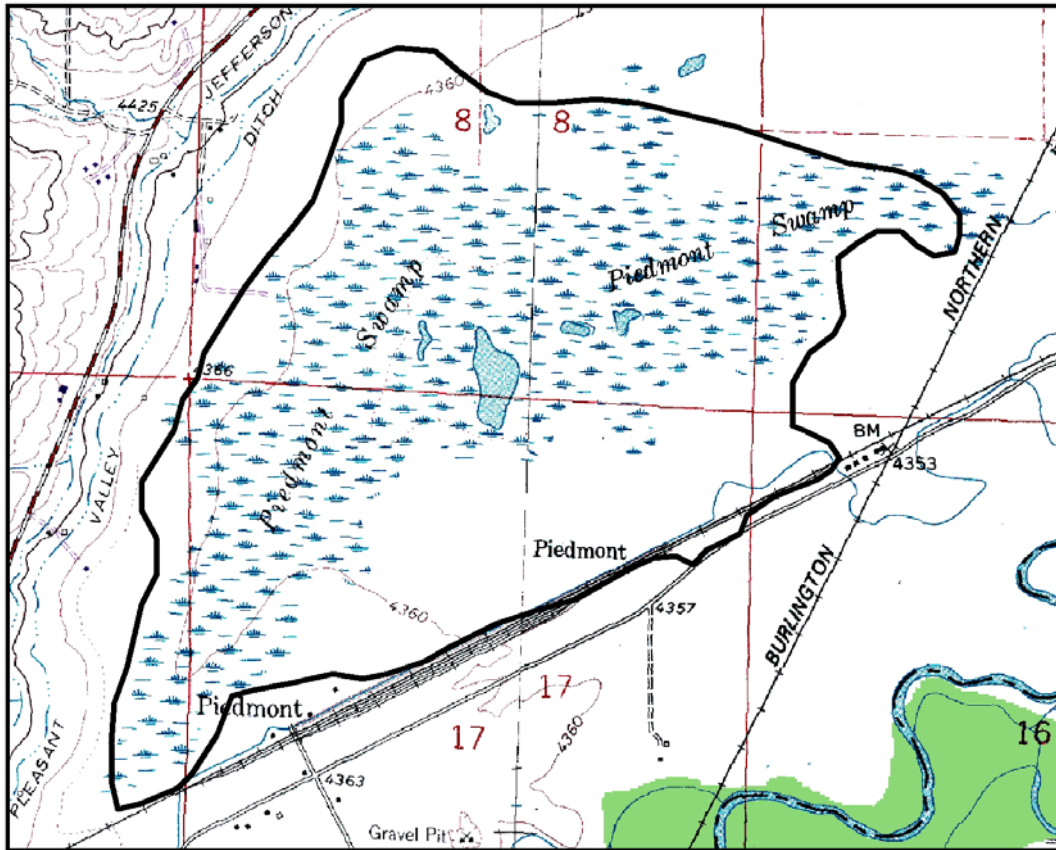
Information Needs

What are beaver populations in the region? How likely is beaver recolonization of the site?

Plant Community Information

Plant Association / Dominance Type	Rarity Ranks		Viability Rank	EO? (Y/N)
	State	Global		
<i>Carex utriculata</i> Herbaceous Vegetation	S5	G5	A	N
<i>Salix geyeriana</i> / <i>Carex utriculata</i> Shrubland	S5	G5	A	N
<i>Salix drummondiana</i> / <i>Carex utriculata</i> Shrubland	S4	G4	B	Y

Piedmont Swamp



Directions

Note: This site is located on private land, and landowner permission is needed to access this site. This site is located just south of the town of Whitehall. From State Route 2 in Whitehall, travel south on Kountz Road for about 1.4 miles. Immediately after crossing the railroad tracks, turn east onto Piedmont Road and travel for approximately 1.4 miles to a gate in the fenceline north of the road. The site lies to the north of the road and can be accessed through the gate.

Description

The Piedmont Swamp site includes a very large alkaline marsh (approximately 475 acres / 192 hectares) and adjacent subirrigated areas (670 acres / 270 hectares total). The groundwater-fed marsh ranges from seasonally to semipermanently flooded and includes one 5-acre permanently flooded pond as well as several smaller seasonally flooded depressions. Soils are silty clay, silty clay loam, and clay loam. Some areas have up to 13 cm of peat accumulation.

Two vegetation communities dominate the marsh: *Typha latifolia* (Broadleaf Cattail) and *Schoenoplectus pungens* (Three-Square). The *Typha* community covers approximately 240 acres (100 hectares) of the marsh and occupies most of the northern portion of the site. It also occurs as narrow stringers along small swales with aerated surface water. This community is largely characterized by a monospecific stand of *Typha latifolia*, although *Schoenoplectus acutus* (Hard-Stem Bulrush), *Schoenoplectus tabernaemontani* (Soft-Stem Bulrush), and *Carex nebrascensis* (Nebraska Sedge) are all important co-dominants in places. The more species rich *Schoenoplectus pungens* community occupies

most of the southern portion of the marsh. This community is co-dominated by *Schoenoplectus pungens*, *Juncus balticus* (Baltic Rush), and *Puccinellia nuttalliana* (Nuttall's Alkaligrass). *Carex nebrascensis* (Nebraska Sedge) and *Carex aquatilis* (Water Sedge) are other common co-dominants, and these sedges dominate some small patches. Other common species in the *Schoenoplectus pungens* community include *Elymus trachycaulus* (Slender Wildrye), *Spartina gracilis* (Alkali Cordgrass), *Muhlenbergia richardsonis* (Mat Muhly), *Hordeum jubatum* (Fox-Tail Barley), *Carex praegracilis* (Clustered Field Sedge), *Triglochin maritima* (Seaside Arrow-Grass), *Crepis runcinata* (Meadow Hawk's-Beard), and *Lycopus asper* (Rough Water-Horehound). *Spartina gracilis*, *Distichlis spicata* (Saltgrass), *Sporobolus airoides* (Alkali-Sacaton), and *Muhlenbergia asperifolia* (Alkali Muhly) become more abundant in drier areas. A *Sarcobatus vermiculatus* / *Distichlis spicata* (Greasewood / Saltgrass) community occupies adjacent elevated flats with subirrigated sandy loam and sandy clay loam soils.

The southeastern portion of the site contains a meandered swale associated with the Jefferson River. The swale supports *Schoenoplectus pungens* and *Carex aquatilis* communities as well as an aquatic community dominated by *Zannichellia palustris* (Horned-Pondweed). The swale is fringed by a shrub community dominated by *Shepherdia argentea* (Silver Buffalo-Berry), *Rosa woodsii* (Woods' Rose), and *Ribes aureum* (Golden Currant).

A previous botanical inventory documented two additional wetland communities: *Puccinellia distans* / *Distichlis spicata* (Spreading Alkali Grass / Saltgrass) and *Scirpus nevadensis* (Nevada Bulrush).

Key Environmental Factors

This wetland is created and maintained by groundwater discharge.

Rarity

This site supports populations of two rare plants: *Spiranthes diluvialis* (Ute Ladies'-Tresses; S2 / G2, federally listed threatened) and *Castilleja minor* ssp. *minor* (= *Castilleja exilis*, Alkali Indian-Paintbrush; S2 / G5). Both species are locally common at the site. Franklin's Gull (*Larus pipixcan*; S3B / G4G5) was observed at the marsh at the time of the site visit.

Other Values

This large marsh is a unique occurrence in southwestern Montana, and supports regionally important populations of *Schoenoplectus pungens* (Three-Square), *Scirpus nevadensis* (Nevada Bulrush), and *Triglochin maritima* (Seaside Arrow-Grass).

Land Use

This site is grazed by livestock, and some areas on the southern periphery of the marsh are extensively hummocked. A drainage ditch in northern portion of the marsh has altered the site's hydrology to an unknown extent.

Exotics

The marsh itself is largely free of exotic species; however, exotics are common in the adjacent uplands. These include *Centaurea biebersteinii* (Spotted Knapweed), *Cirsium arvense* (Canadian Thistle), *Alopecurus pratensis* (Field Meadow-Foxtail), and *Cardaria draba* (Heart-Pod Hoarycress). Scattered individuals of *Elaeagnus angustifolia* (Russian Olive) are present, but they do not appear to be reproducing.

Uplands

The site is bordered by valley bottom rangeland. Residential development, associated with the town of Whitehall is common along the southern and western boundaries. Golden Sunlight Mine is using the property to the east to store fill.

Information Needs

To what extent has the site's hydrology been altered? Modifications include a drainage ditch in the northern portion of the wetland, the Pleasant Valley Ditch and Jefferson Canal to the west, the ditching of Fish Creek to the southwest, and the construction of the (now abandoned) railroad bed across the marsh's southern boundary. Cattails at the site were identified as *Typha latifolia* (Broadleaf Cattail). They should be examined again to make certain they are not the hybrid *Typha × glauca*, which can be a much more aggressive colonizer. Cattails dominate the northern half of the site; however, the southern portion of the marsh may be too dry late in the season to support *Typha*.

Management Needs

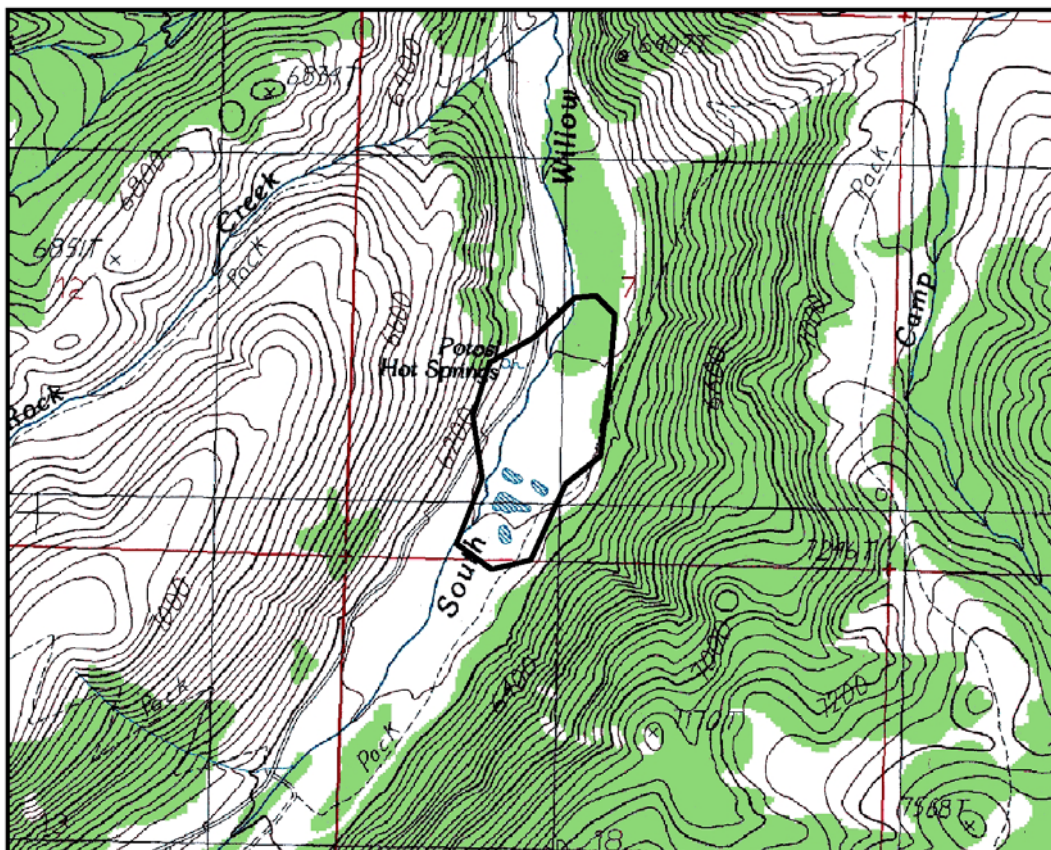
Centaurea biebersteinii (Spotted Knapweed) infests the abandoned railroad grade adjacent to the meandered wetland.

Plant Community Information

Plant Association / Dominance Type	Rarity Ranks		Viability Rank	EO? (Y/N)
	State	Global		
<i>Carex aquatilis</i> Herbaceous Vegetation	S4	G5	B	N
<i>Sarcobatus vermiculatus</i> / <i>Distichlis spicata</i> Shrubland	S2	G4	B	N
<i>Schoenoplectus pungens</i> Herbaceous Vegetation	S3	G3G4	B	Y
<i>Spartina gracilis</i> Herbaceous Vegetation	SP	GU	B	N
<i>Typha latifolia</i> Western Herbaceous Vegetation	S5	G5	*	N

* Rank not assigned

Potosi Hot Spring



Directions

Note: At least a portion of this site is located on private land and consequently landowner permission is required to access that area. Access this site by driving from Pony, Montana (at the terminus of State Route 283) southward on U.S. Forest Service Road #160 approximately 7.8 miles; the site is about 0.95 miles beyond the confluence of South Willow Creek and Potosi Creek, which merges from the west. The spring is located on private land approximately 50 feet upslope from the road (#160).

Description

Potosi Hot Springs is located on the east flank of the Tobacco Root Mountains at 6,160 feet elevation. The springs issue from a steep slope 50 feet above the valley bottom of South Willow Creek and course downslope as several rivulets. Accessing the spring requires owner permission. Wetland vegetation is developed on the slope and also occurs on the flat at the slope bottom. The wetland vegetation included the following types, *Eleocharis rostellata* (beaked spike-sedge, characterizing the wettest, warmest environments), *Eleocharis pauciflora* (few-flowered spike-sedge), and *Eleocharis palustris* (common spike-sedge); all communities are virtually monospecifically dominated by the nominal species.

Key Environmental Factors

“Hot water” from a subterranean source continuously rises to the surface and spills down the slope as the predominant source of groundwater to this site.

Rarity

Eleocharis rostellata, in addition to being considered a rare plant, dominates and defines a rare community type. *Epipactis gigantea* (giant helleborine) is the other rare wetland plant present.

Other Values

At the time of inventory the wetland vegetation appeared to be in near-pristine condition. This hot spring habitat supports a population of lightning bugs (Family Lampyridae) and quite possibly may support other rare insects or invertebrates (because of the uniqueness of the habitat).

Land Use

The springs are undeveloped with the exception of a minor diversion of hot water to the owner's house to fill a small pool. The near-pristine condition reflects the lack of use of the springs as well as the adjacent uplands.

Information Needs

Protecting the site's biological value is clearly dependent upon understanding its hydrology, which has not yet been elucidated. Hansen et al. 1995 consider sites dominated by *Eleocharis rostellata* to be ecologically equivalent to those dominated by *Eleocharis quinqueflora* (formerly *E. pauciflora*) and according have designated the community name to be *E. quinqueflora*. The MTNHP believes there is sufficient habitat distinction reflected by the dominance of these respective species to warrant separate community names, but more site-specific data are needed to elucidate their respective ecologies. Apparently exotic species, noxious or merely aggressive aliens, have not been inventoried to date.

Management Needs

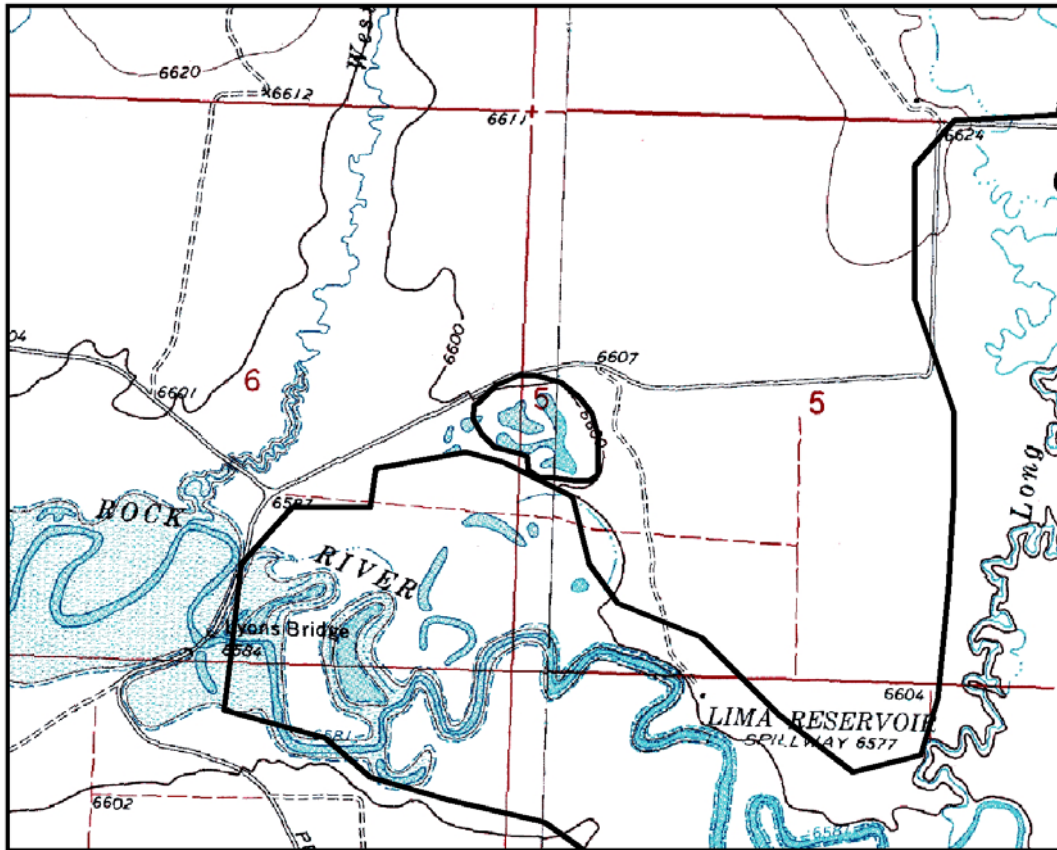
The water diversion to the house maintains the present conditions. If this flow was discontinued and not replaced with another diversion of similar volume, the wetlands may not be maintained in their present condition and extent.

Plant Community Information

Plant Association / Dominance Type	Rarity Ranks		Viability Rank	EO? (Y/N)
	State	Global		
<i>Eleocharis palustris</i> Herbaceous Vegetation	S5	G5	*	N
<i>Eleocharis quinqueflora</i> Herbaceous Vegetation	S3	G4	*	N
<i>Eleocharis rostellata</i> Dominance Type	S1	*	*	N

* Rank not assigned

Red Rock Fen



Directions

This site is located in the Centennial Valley upstream from Lima Reservoir. From Monida, travel east on the main Centennial Valley road for approximately 10 miles. Turn north onto the Ruby Valley Road and travel approximately 3 miles to Lyons Bridge. The site is located approximately 0.7 mile east of the bridge.

Description

This site consists of two small peatlands (total size is approximately 2 acres / 1 hectare). These peatlands occur at the base of a toeslope and sit slightly above the meandered floodplain complex associated with the Red Rock River. These areas are underlain with fibric peat to a depth of at least 50 cm and support a previously undocumented community dominated by *Salix candida* (Hoary Willow), *Juncus balticus*, and the moss *Bryum pallescens*. Shrub cover is low (10 percent) and includes *Salix candida*, *Salix bebbiana* (Bebb Willow), *Salix planifolia* (Plane-Leaf Willow), and *Dasiphora fruticosa* ssp. *floribunda* (Shrubby Cinquefoil). The herbaceous layer is dominated by *Juncus balticus*; other common species include *Elymus trachycaulus* (Slender Wheatgrass), *Carex nebrascensis* (Nebraska Sedge), *Muhlenbergia richardsonis*, *Carex simulata* (Short-Beaked Sedge), *Thalictrum alpinum* (Alpine Meadow-Rue), *Triglochin maritima* (Seaside Arrow-Grass), *Pedicularis groenlandica*, *Camassia quamash* (Small Camas), and *Parnassia palustris* (Marsh Grass-of-Parnassus). *Bryum pallescens* forms a continuous moss layer.

Key Environmental Factors

This site receives groundwater discharge and is perched above the meandered Red Rock River floodplain. A stable hydrologic regime and saturated conditions have inhibited the decomposition of vegetation, creating conditions conducive to the formation of organic soils. Continued hydrological stability is critical to maintaining the character of this site.

Rarity

A previously undocumented *Salix candida* / *Juncus balticus* (Hoary Willow / Baltic Rush) community with a continuous layer of *Bryum pallescens* was documented at the site.

Other Values

This small peatland has significant conservation value. Peatlands are a rare wetland type in Montana and are especially rare in the southwestern portion of the state.

Land Use

This area has not been grazed for approximately 20 years.

Exotics

No exotic species are present.

Uplands

Rangelands dominated by shrub-herbaceous communities comprise the uplands. Dominant species include *Artemisia tripartita* (Three-Tip Sagebrush), *Ericameria nauseosa* (Common Rabbitbrush), and *Festuca idahoensis* (Idaho Fescue).

Information Needs

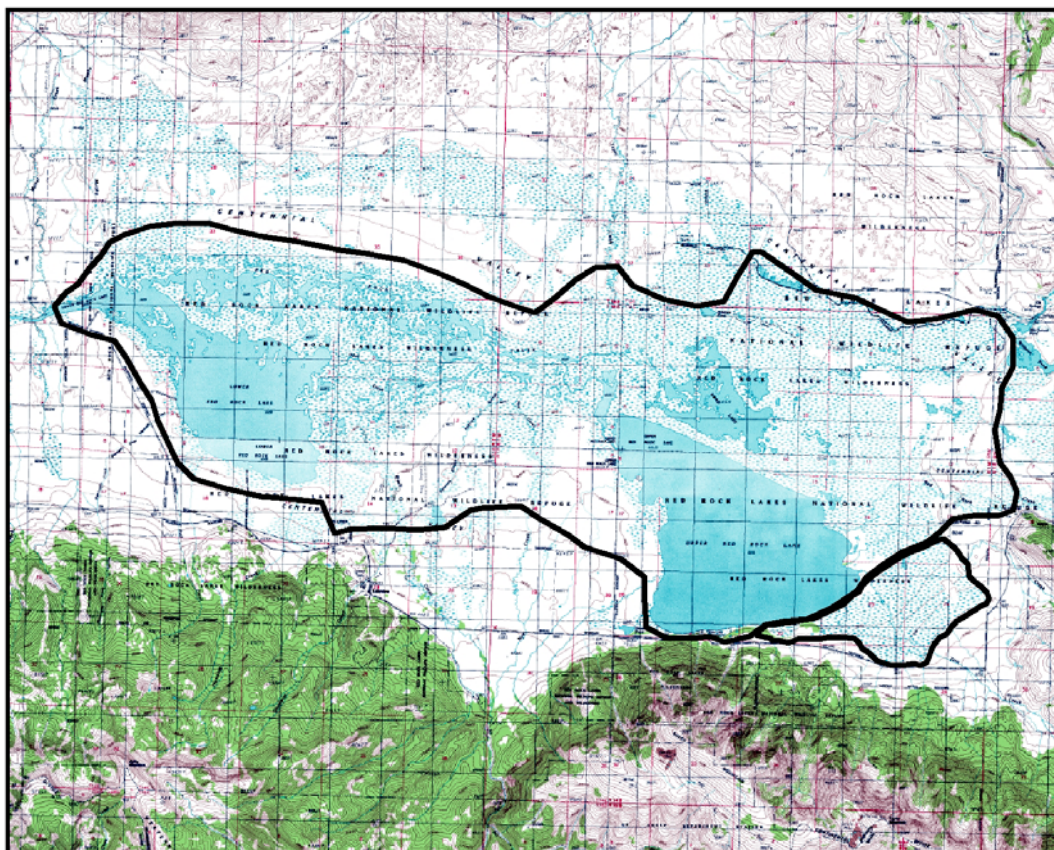
What effect does the Ruby Valley Road have on the hydrology of the western peatland?

Plant Community Information

Plant Association / Dominance Type	Rarity Ranks		Viability Rank	EO? (Y/N)
	State	Global		
<i>Salix candida</i> / <i>Juncus balticus</i> Dominance Type	*	*	B	Y

* Rank not assigned

Red Rock Lakes



Directions

This site is located within the Red Rock Lakes National Wildlife Refuge. From Monida, travel east on the main Centennial Valley road for approximately 24 miles. Turn north at the sign for the Lower Lake Campground and travel about 3 miles to the campground. The western portion of the site can be accessed from here.

Description

This site consists of lacustrine fringe and palustrine communities around Lower Red Rock Lake and along the Red Rock River between Lower and Upper Red Rock Lakes. Vegetation occurs in zonal patterns along a topographical and soil moisture gradient (soil texture and chemistry may be other important factors in delimiting vegetation communities). Lake bottom sediments, and by extension, lacustrine fringe soils, have high concentrations of available calcium, magnesium, and organic matter and low concentrations of phosphorus and sodium. Where sampled, soil texture was silty clay and silty clay loam.

Carex utriculata (Beaked Sedge) occupies the wettest emergent vegetation zone and fringes open water. *Carex aquatilis* (Water Sedge) and *Schoenoplectus acutus* (Hard-Stem Bulrush) communities form localized inclusions within this community. *Carex utriculata* forms extensive stands in these wetlands, and it is the predominant plant community at this site. *Juncus balticus* (Baltic Rush) fringes the *Carex utriculata* community and dominates a narrow to broad zone on somewhat higher and drier locations. On wider flats, *Carex praegracilis* (Clustered Field Sedge) co-dominates with *Juncus balticus*. On some higher areas (perhaps with higher soil alkalinity), a *Sarcobatus vermiculatus* / *Distichlis spicata*

- *Puccinellia nuttalliana* (Greasewood / Saltgrass - Nuttall's Alkaligrass) shrubland becomes the dominant plant community. *Puccinellia nuttalliana* is the dominant grass in this community, although *Distichlis spicata* is abundant in localized patches. The *Sarcobatus* shrubland is relatively narrow and grades into a *Leymus cinereus* - *Puccinellia nuttalliana* (Basin Wildrye - Nuttall's Alkaligrass) herbaceous community, which occupies the least mesic portion of the site.

Key Environmental Factors

The hydrology of this site is influenced primarily by groundwater discharge, stream inflow, and infiltration from snowmelt. Additionally, Upper Red Rock Lake receives thermal groundwater discharge.

Rarity

These wetlands support breeding populations of numerous special status bird and amphibian species, including Trumpeter Swan (*Cygnus buccinator*; S2B,S2N / G4), Black-crowned Night-heron (*Nycticorax nycticorax*; S3B?,SZN / G5), White-faced Ibis (*Plegadis chihi*; S1B,SZN / G5), Franklin's Gull (*Larus pipixcan*; S3B,SZN / G4G5), Forster's Tern (*Sterna forsteri*; S2B,SZN / G5), and Boreal Toad (*Bufo boreas*; S3 / G4). Lower Red Rock Lake also supports a population of Montana Arctic Grayling (*Thymallus arcticus montanus*; S1 / G5T1Q). Rare plant species documented at the site include *Carex idaho* (Idaho Sedge; S2 / G2Q), *Downingia laeta* (Great Basin Downingia; S1 / G5), and *Thelypodium sagittatum* ssp. *sagittatum* (Slender Thelypody; S2 / G4).

Other Values

In addition to breeding populations of special status species, this site also supports breeding populations of Western Chorus Frog (*Pseudacris triseriata*), Columbia Spotted Frog (*Rana luteiventris*), and Tiger Salamander (*Ambystoma tigrinum*).

Land Use

Current land use includes grazing by domestic livestock and historically included the conversion of some wetlands to pasture. The hydrology of both Upper and Lower Red Rock Lakes has been altered by a water control structure that has raised lake levels by approximately 1 foot. This modification may have a significant influence on the ecology of these lakes by altering aquatic vegetation communities. Other modifications include levees and the creation of artificial ponds northeast of Swan Lake.

Exotics

Exotic species are a minor component of these wetlands and include localized populations of *Alopecurus pratensis* (Meadow Foxtail), *Phalaris arundinacea* (Reed Canarygrass), *Poa pratensis* (Kentucky Bluegrass), and *Taraxacum officinale* (Common Dandelion).

Uplands

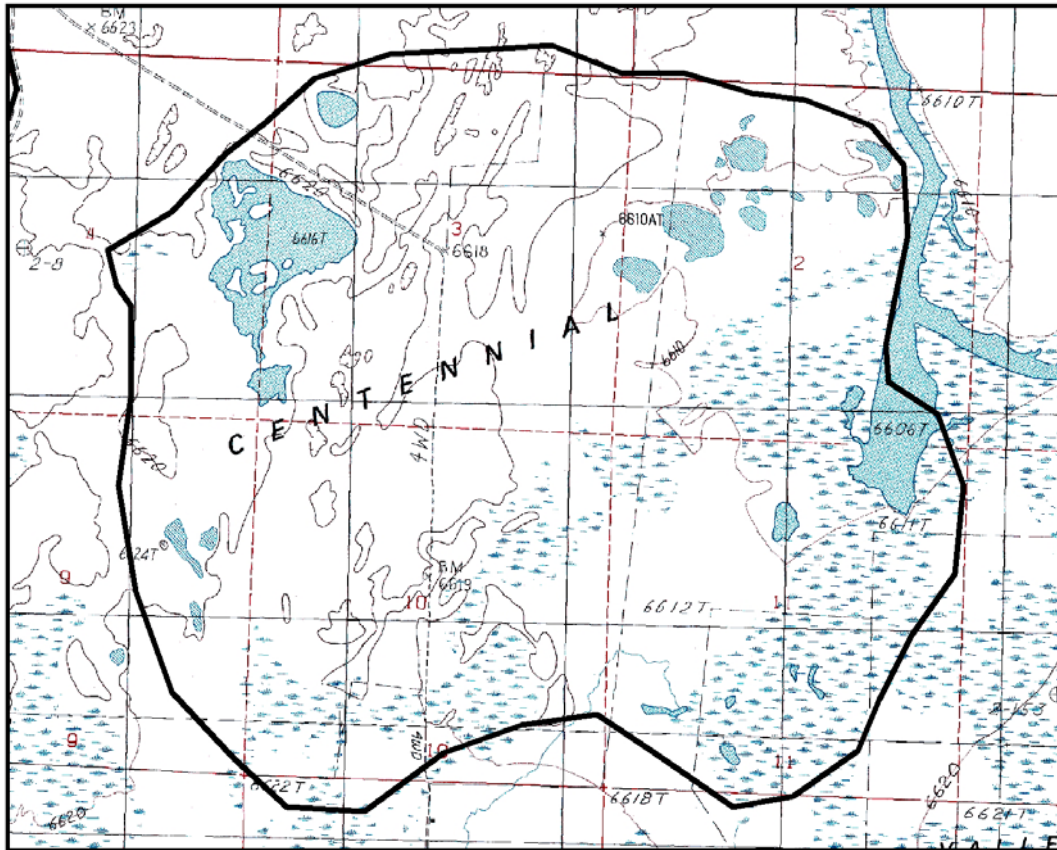
Uplands are intact native rangelands and forest.

Plant Community Information

Plant Association / Dominance Type	Rarity Ranks		Viability Rank	EO? (Y/N)
	State	Global		
<i>Carex aquatilis</i> Herbaceous Vegetation	S4	G5	A	N
<i>Carex utriculata</i> Herbaceous Vegetation	S5	G5	A	N
<i>Juncus balticus</i> Herbaceous Vegetation	S5	G5	A	N
<i>Juncus balticus</i> - <i>Carex praegracilis</i> Dominance Type	S?	*	A	N
<i>Leymus cinereus</i> - <i>Puccinellia nuttalliana</i> Dominance Type	S?	*	A	N
<i>Sarcobatus vermiculatus</i> / <i>Distichlis spicata</i> - (<i>Puccinellia nuttalliana</i>) Shrubland	*	G?	A	N
<i>Schoenoplectus acutus</i> Herbaceous Vegetation	S5	G5	A	N

* Rank not assigned

Red Rock Ponds



Directions

Note: Portions of this site are located on private land, and landowner permission is required to access these areas. These ponds are located in the Centennial Valley below the Red Rock Lakes National Wildlife Refuge. From Monida, travel east on the main Centennial Valley road for approximately 19 miles. Turn north onto Brundage Lane and travel approximately 3 miles until the road turns to the northwest. The site lies on both sides of road.

Description

This site consists of subirrigated meadows with numerous alkali ponds. These ponds vary from temporarily flooded to intermittently exposed and are underlain by silty clay loam soil. The vegetation communities at this site appear to be primarily delimited along a soil moisture gradient (although soil texture and probably chemistry change as well). *Carex utriculata* (Beaked Sedge) communities occur in the wettest locations fringing permanently to near-permanently flooded ponds. *Juncus balticus* (Baltic Rush) communities fringe temporarily and seasonally flooded ponds and occupy large expanses of low-lying flats. Slightly less mesic locations are dominated by *Hordeum jubatum* (Fox-Tail Barley) and *Distichlis spicata* (Saltgrass) communities. The *Hordeum jubatum* community has localized inclusions of a *Triglochin maritima* (Seaside Arrow-Grass) community. On higher locations underlain by sandy loam, vegetation shifts to a *Sarcobatus vermiculatus* / *Distichlis spicata* (Greasewood / Saltgrass) shrubland. This community has a low cover (10 – 20 percent) of *Sarcobatus vermiculatus* and a ground layer dominated by *Distichlis spicata* and *Puccinellia nuttalliana* (Nuttall's Alkaligrass). Other common

species include *Hordeum jubatum*, *Leymus cinereus* (Basin Wildrye), *Poa secunda* (*Poa juncifolia* form, Alkali Bluegrass), and *Suaeda calceoliformis* (Paiuteweed).

There is also an interesting community associated with what appear to be frost-heave mounds. *Hordeum jubatum* dominates between the mounds while the mounds themselves are co-dominated by *Carex praegracilis* (Clustered Field Sedge), *Distichlis spicata*, and *Puccinellia nuttalliana*, with low cover of *Elymus trachycaulus* (Slender Wildrye), *Juncus balticus*, and *Suaeda calceoliformis*.

Key Environmental Factors

The seasonally shallow water table and availability of groundwater along with high alkalinity is primarily responsible for the vegetation composition at this site.

Rarity

No rare plants or animals were documented at this site. This site does support a large example of an S2 / G4 community, *Sarcobatus vermiculatus* / *Distichlis spicata* (Greasewood / Saltgrass). This community is in fair condition.

Land Use

The primary land use of these wetlands is livestock grazing. The southern portion of the site has been hydrologically altered through ditching, the creation of berms, and excavation. These modifications have altered natural water movements and have artificially ponded water in places. These modifications may have been done to improve stock water access or waterfowl habitat.

Exotics

Few exotic species were noted at this site. This is probably a product of the limited presence of exotic species in the Centennial Valley in general and the alkaline nature of this site. Minor populations of *Poa pratensis* (Kentucky Bluegrass) and *Alopecurus pratensis* (Meadow Foxtail) were documented.

Uplands

The uplands are predominantly composed of an *Artemisia tripartita* / *Festuca idahoensis* (Three-Tip Sagebrush / Idaho Fescue) shrub-herbaceous community. Land use in the uplands is similar to that on the site.

Information Needs

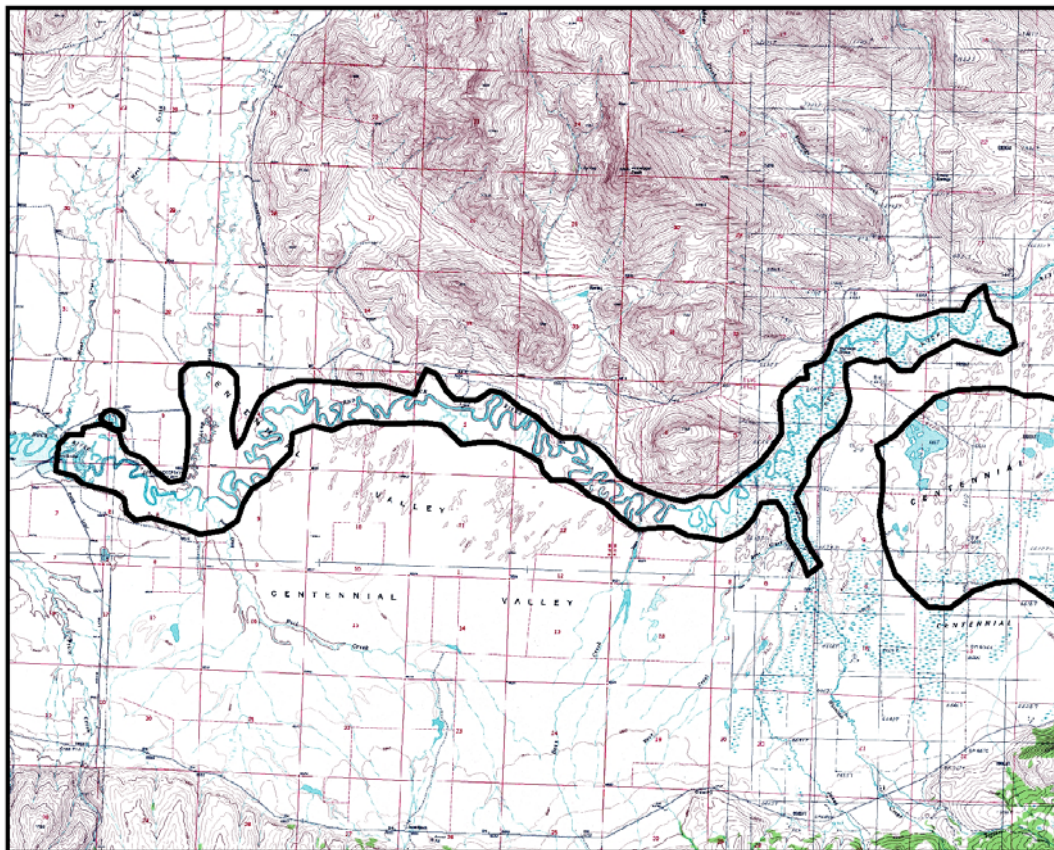
What effect does the ditching have on the hydrology of individual ponds?

Plant Community Information

Plant Association / Dominance Type	Rarity Ranks		Viability Rank	EO? (Y/N)
	State	Global		
<i>Distichlis spicata</i> Herbaceous Vegetation	S4	G5	B	N
<i>Hordeum jubatum</i> Herbaceous Vegetation	S4	G4	B	N
<i>Juncus balticus</i> Herbaceous Vegetation	S5	G5	B	N
<i>Sarcobatus vermiculatus</i> / <i>Distichlis spicata</i> Shrubland	S2	G4	B	N
<i>Triglochin maritima</i> Herbaceous Vegetation	*	GU	B	N

* Rank not assigned

Red Rock River / Centennial Valley



Directions

Note: Portions of this site are located on private land, and landowner permission is required to access those areas. This site is located in the Centennial Valley between the Red Rock Lakes National Wildlife Refuge and the draw down zone of Lima Reservoir. From Monida, travel east on the main Centennial Valley road for approximately 10 miles. The west end of the site can be reached by turning north onto the Ruby Valley Road and traveling approximately 3 miles to Lyons Bridge. The east end of the site is located about a mile upstream of the Brundage Lane Bridge, approximately 8.5 miles to the east.

Description

These wetlands occupy the floodplain of the Red Rock River and tributaries from Lower Red Rock Lake to the drawdown zone of Lima Reservoir. The floodplain in this reach has a diverse macrotopography with many oxbows and old meander channels. The site has been historically grazed, often heavily, judging from the extreme soil hummocking in wetter areas (microrelief often exceeds 2 feet). The main tributaries in this reach, Long and Winslow Creeks, are deeply incised with steep and eroded banks. Streambanks are composed of fine sediments and are undercut with some slumping. Point bars along the Red Rock River are well vegetated except for localized areas where vegetation is absent from trampling (a common occurrence along the reach). Soils are fine textured: surface layers are silty and sandy clay loams underlain by loamy sand and sandy loam. The subsoil has abundant and prominent redoximorphic features. Some areas have a thin (2.5 to 5 cm) organic horizon of fibric peat.

Wetter oxbows intercept groundwater and support aquatic communities that include *Potamogeton foliosus* (Leafy Pondweed), *Potamogeton richardsonii* (Red-Head Pondweed), *Sparganium angustifolium* (Narrowleaf Bur-Reed), *Ranunculus aquatilis* (White Water-Crowfoot), and *Myriophyllum sibiricum* (Siberian Water-Milfoil). *Carex utriculata* (Beaked Sedge) and *Eleocharis palustris* (Common Spikerush) communities fringe these oxbows. Other sloughs do not have an open water component and support more extensive *Carex utriculata* communities. These communities are near monospecific stands of *Carex utriculata* or *Eleocharis palustris*; incidental species associated with the *Carex utriculata* community include *Eleocharis palustris*, *Mentha arvensis* (Field Mint), *Rumex aquaticus* (Western Dock), *Ranunculus gmelinii* (Gmelin's buttercup), *Sium suave* (Hemlock Water-Parsnip), and *Beckmannia syzigachne* (American Slough Grass).

The floodplain is predominantly a mosaic of three floristically similar communities: *Deschampsia caespitosa* (Tufted Hairgrass), *Juncus balticus* – *Carex praegracilis* (Baltic Rush – Clustered Field Sedge), and *Carex praegracilis*. Small, often narrow *Juncus balticus* and *Eleocharis palustris* communities occur in more mesic areas and are often transitional to *Carex utriculata* communities. *Juncus balticus* and *Carex praegracilis* are the most widespread dominant species in the floodplain; *Deschampsia caespitosa* is well represented throughout but is only occasionally the dominant species. Other locally well-represented species include *Carex aquatilis* (Water Sedge), *Calamagrostis stricta* (Slimstem Reedgrass), *Festuca rubra* (Red Fescue), and *Muhlenbergia richardsonis* (Mat Muhly). Forbs are locally abundant, probably due to higher levels of herbivory. Common species include *Symphyotrichum spathulatum* (= *Aster occidentalis*, Western Mountain Aster), *Senecio hydrophilus* (Alkali-Marsh Ragwort), *Mentha arvensis*, *Iris missouriensis* (Rocky Mountain Iris), *Pedicularis groenlandica* (Elephant's-Head), *Cirsium scariosum* (Meadow Thistle), *Allium schoenoprasum* (Wild Chives), and *Valeriana edulis* (Tobacco-Root). Willow communities are absent from this site, although individual willows are present (well-browsed stems of *Salix geyeriana* [Geyer's willow] were noted along the river channel). Willows are also naturally re-establishing and being planted along Long Creek.

Some drier and more alkaline low terraces are occupied by *Sarcobatus vermiculatus* / *Distichlis spicata* – *Puccinellia nuttalliana* (Greasewood / Saltgrass – Nuttall's Alkaligrass) and *Pascopyrum smithii* – *Distichlis spicata* communities. The *Sarcobatus* community is sparsely vegetated with low cover of *Sarcobatus vermiculatus*, *Puccinellia nuttalliana*, and *Poa secunda* (*Poa juncifolia* form, Alkali Bluegrass) and has sporadic cover of *Leymus cinereus* (Basin Wildrye).

Key Environmental Factors

The hydrologic regime is the key abiotic driver at this site. High groundwater tables, flood disturbance, and channel migration are primarily responsible for the vegetation patterns of these wetlands. However, historic livestock grazing has also significantly affected plant communities at this site. The absence of a shrub component to the vegetation is likely a result of historic grazing practices.

Rarity

Two rare plant species were documented at this site: *Thalictrum alpinum* (Alpine Meadow-Rue; S2 / G5) and *Primula incana* (Mealy Primrose; S2 / G4G5). The *Thalictrum alpinum* population was previously documented from a 1997 survey. The same survey identified a population of *Primula incana* occurring adjacent to the *Thalictrum alpinum*, but this population was not relocated. However, two other populations of *Primula incana* were located in the floodplain – one near the upper edge of the site and one near the middle. This site also contains an active Peregrine Falcon (*Falco peregrinus*; S2B, SZN / G4) hack site.

Other Values

Because of the concentrated land ownership this site affords excellent restoration opportunities. This and other surveys have documented the presence of Western Chorus Frog (*Pseudacris triseriata*) at this site.

Land Use

Livestock grazing is the primary land use. Ditching, especially along Long Creek, has also created localized hydrological alterations. To improve waterfowl habitat, the BLM has created open water moats on some of their parcels.

Exotics

Exotic species are a very minor component of the vegetation at this site. *Poa pratensis* (Kentucky Bluegrass) is present throughout the site at very low cover values. *Cirsium arvense* (Canada Thistle), *Taraxacum officinale* (Common Dandelion), *Trifolium repens* (White Clover), and *Phleum pratense* (Common Timothy) occur in localized areas at low to moderate cover values.

Uplands

Rangelands dominated by shrub-herbaceous communities comprise the uplands. Dominant species include *Artemisia tripartita* (Three-Tip Sagebrush), *Ericameria nauseosa* (Common Rabbitbrush), and *Festuca idahoensis* (Idaho Fescue).

Information Needs

How significantly has the hydrology of the Red Rock River been affected by the small dam below Lower Red Rock Lake?

Management Needs

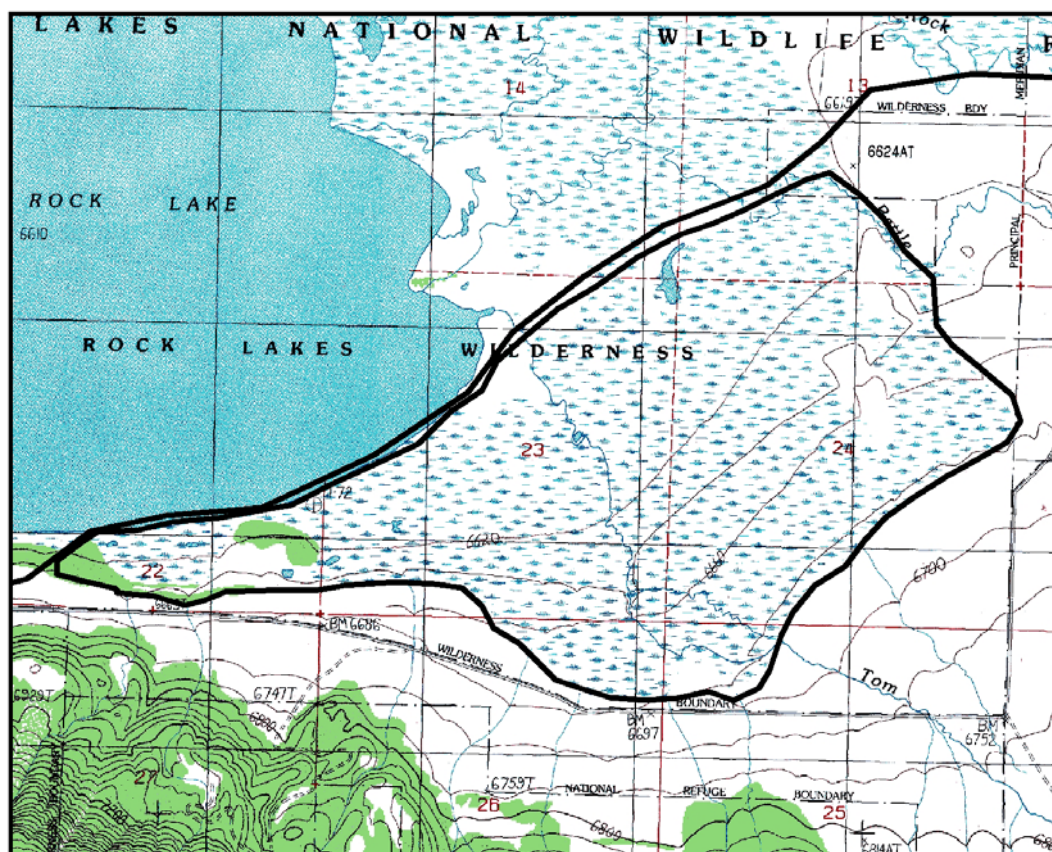
Appropriate grazing management could greatly benefit the ecological integrity of this site. It is likely that the near-absence of woody vegetation is the result of historic livestock grazing. Grazing has also created significant hummocking.

Plant Community Information

Plant Association / Dominance Type	Rarity Ranks		Viability Rank	EO? (Y/N)
	State	Global		
<i>Carex praeegracilis</i> Herbaceous Vegetation	S3S4	G3G4	B	N
<i>Carex praeegracilis</i> - <i>Carex aquatilis</i> Herbaceous Vegetation	*	G3	B	N
<i>Carex utriculata</i> Herbaceous Vegetation	S5	G5	B	N
<i>Deschampsia caespitosa</i> Herbaceous Vegetation	S4	G4	B	N
<i>Eleocharis palustris</i> Herbaceous Vegetation	S5	G5	B	N
<i>Juncus balticus</i> Herbaceous Vegetation	S5	G5	B	N
<i>Juncus balticus</i> - <i>Carex praeegracilis</i> Dominance Type	S?	*	B	N
<i>Pascopyrum smithii</i> - <i>Distichlis spicata</i> Herbaceous Vegetation	SP	G4	B	N
<i>Potamogeton foliosus</i> Herbaceous Vegetation		G3?	B	N
<i>Sarcobatus vermiculatus</i> / <i>Distichlis spicata</i> - (<i>Puccinellia nuttalliana</i>) Shrubland	*	G?	B	N

* Rank not assigned

Red Rock Willows



Directions

This site is located within the Red Rock Lakes National Wildlife Refuge near the southeastern shore of Upper Red Rock Lake. From Monida, travel east on the main Centennial Valley Road for approximately 32 miles to the Upper Lake Campground. The site is approximately 1.5 miles further along the road and lies between the road and Upper Red Rock Lake.

Description

This site occurs on an alluvial fan and lakeshore adjacent to Upper Red Rock Lake. This wetland has numerous groundwater discharge points in the form of small springs and rivulets in addition to receiving surface water from Tom and Battle Creeks. There are also many small ponds in the wetland. Soils are comprised of a fibric peat layer from 25 to >56 cm deep, although organic horizons greater than 30 cm thick appear to be localized. This peat layer is underlain by silty clay loam and silty clay. Some deeper mineral horizons (depth >50 cm) are gleyed gravelly silty clays with many prominent redoximorphic features.

Most of this site is occupied by a mosaic of low to medium willow communities, including *Salix wolfii* / *Carex aquatilis* (Wolf Willow / Water Sedge), *Salix wolfii* / *Juncus balticus* (Wolf Willow / Baltic Rush), and *Salix boothii* / *Carex utriculata* (Booth's Willow / Beaked Sedge). Willow cover ranges from open to dense. The dominant graminoids are *Carex aquatilis*, *Carex utriculata*, and *Juncus balticus*; *Deschampsia caespitosa* (Tufted Hairgrass) is locally common in the *Salix wolfii* / *Juncus balticus* community. Forbs have low cover in all these stands; the most common species include *Pedicularis*

groenlandica (Elephant's-Head), *Allium schoenoprasum* (Wild Chives), *Geranium richardsonii* (White Crane's-Bill), *Antennaria lanata* (Woolly Pussytoes), and *Solidago canadensis* (Canada Goldenrod). *Salix planifolia* (Plane-Leaf Willow), and *Rhamnus alnifolia* (Alder-Leaf Buckthorn) are common associated shrubs. Clumps of tall willows, including *Salix geyeriana* (Geyer's Willow), *Salix boothii* (Booth's Willow), *Salix drummondiana* (Drummond's Willow), and *Salix bebbiana* (Bebb Willow), are locally co-dominant on the lower flat and along the stream channels. Although *Salix wolfii* is the dominant willow throughout, *Betula glandulosa* (Bog Birch) and *Dasiphora fruticosa* ssp. *floribunda* (Shrubby Cinquefoil) become co-dominant on many localized patches. These areas also have high cover of *Arctostaphylos uva-ursi* (Kinnikinnick) and support a continuous moss layer dominated by *Tomentypnum nitens* and *Aulacomnium palustre*.

An old-growth *Picea engelmannii* / *Equisetum arvense* (Engelmann Spruce / Field Horsetail) community occupies approximately 5.5 hectares near the lake. The overstory is comprised of mature *Picea engelmannii* (50-cm diameter-at-breast-height, approximately 170 years old), with scattered very large trees (>85-cm diameter-at-breast-height) present. The ground layer is dominated by *Equisetum arvense*; the dwarf-shrubs *Cornus canadensis* (Bunchberry) and *Linnaea borealis* (Twinberry) are locally abundant. Numerous mesic forbs are present at low cover, including *Actaea rubra* (Red Baneberry), *Thalictrum occidentale* (Western Sweet-Cicely), *Galium triflorum* (Fragrant Bedstraw), *Osmorhiza depauperata* (Blunt-Fruit Sweet-Cicely), *Geum macrophyllum* (Large-Leaf Avens), and *Senecio triangularis* (Arrow-Leaf Ragwort). Graminoids are generally poorly represented and include *Bromus ciliatus* (Fringed Brome), *Calamagrostis canadensis* (Bluejoint Reedgrass), *Carex utriculata* (Beaked Sedge), and *Carex disperma* (Soft-Leaf Sedge). The soil is a black silt loam with high organic matter content. There is a broad ecotone between the spruce and willow-dominated communities characterized by a co-occurrence of spruce and willows and a sedge dominated ground layer.

Key Environmental Factors

The stable groundwater discharge into this wetland has led to the development of a peat layer and is the primary influence on the structure and composition of site's plant communities. Moose (*Alces alces*) herbivory may also be influencing vegetation structure through browsing of willows and *Picea engelmannii* (Engelmann Spruce) seedlings and saplings.

Rarity

This site contains an active Bald Eagle (*Haliaeetus leucocephalus*; S3B,S3N / G4, listed threatened) nest site. Boreal Toad (*Bufo boreas*; S3 / G4) toadlets were found in the small groundwater discharge ponds in the western portion of the site in August 2001. It is likely that they use similar breeding habitat throughout the site. A population of *Thelypodium sagittatum* ssp. *sagittatum* (Slender Thelypody; S2 / G4T?) was documented at this site in 1993.

Other Values

In general, this site has not accumulated enough organic soil to be technically termed a peatland, although localized patches do have peat soil >30 cm. However, it is floristically very similar to a calcareous or rich fen and it shares many of the same functional and habitat values. This type of wetland is relatively rare in Montana in general and is especially rare in southwest Montana. Western Chorus Frogs (*Pseudacris triseriata*) are known from this site.

Land Use

This wetland lies within the Red Rock Lakes Wilderness Area and receives very little human use.

Exotics

Exotic species are a very minor component of these wetlands and include localized populations of *Alopecurus pratensis* (Meadow Foxtail), *Poa pratensis* (Kentucky Bluegrass), and *Taraxacum officinale* (Common Dandelion).

Uplands

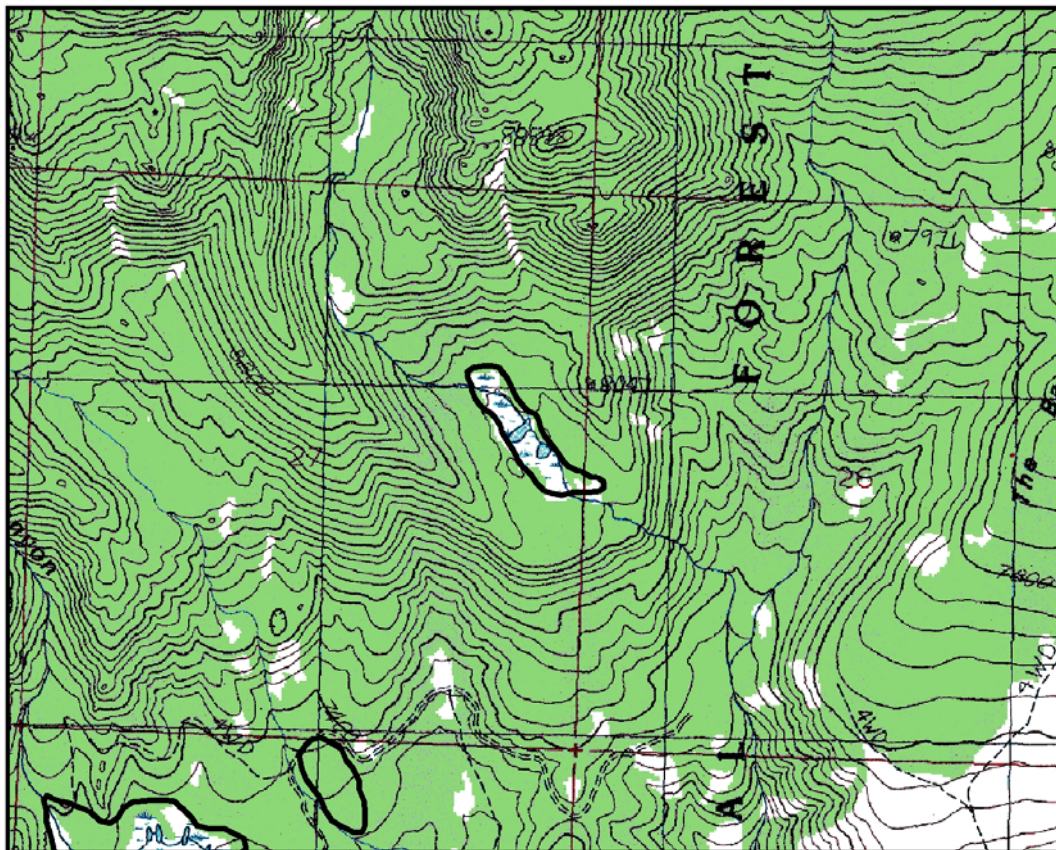
Immediately adjacent to the wetlands, the uplands consist of grasslands dominated by *Poa pratensis* (Kentucky Bluegrass), *Festuca idahoensis* (Idaho Fescue), and *Pascopyrum smithii* (Western Wheatgrass). These grasslands have inclusions of *Artemisia cana* (Silver Sagebrush) and *Artemisia tridentata* ssp. *vaseyana* (Mountain Big Sagebrush) shrublands. Along the lower slopes of the Centennial Range, these grasslands transition into *Pseudotsuga menziesii* / *Calamagrostis rubescens* (Douglas-Fir / Pinegrass) and *Pseudotsuga menziesii* / *Spiraea betulifolia* (Douglas-Fir / White Spiraea) communities.

Plant Community Information

Plant Association / Dominance Type	Rarity Ranks		Viability Rank	EO? (Y/N)
	State	Global		
<i>Betula glandulosa</i> / <i>Carex utriculata</i> Shrubland	S4	G4?	A	Y
<i>Picea engelmannii</i> / <i>Equisetum arvense</i> Forest	S4	G4	A	Y
<i>Salix boothii</i> / <i>Carex utriculata</i> Shrubland	S4	G4	A	N
<i>Salix wolfii</i> / <i>Carex aquatilis</i> Shrubland	S3	G4	A	Y
<i>Salix wolfii</i> / <i>Juncus balticus</i> Dominance Type	*	*	A	?

* Rank not assigned

Table Mountain Wetlands



Directions

This site is located on the southern flank of the Highland Mountains in southwestern Montana. From Twin Bridges, travel north on State Route 41 for approximately 6.5 miles. Just after crossing the Jefferson River, turn south on Forest Route 125. Travel along this road for about 12 miles to the Hells Canyon Guard Station. From the Station, continue up Hells Canyon Creek on Forest Route 9311 for about 2.5 miles. Travel north crosscountry to a bench that lies about 500 feet above the road. The wetlands occur along a tributary to Hells Canyon Creek.

Description

This site is a series of beaver-influenced wet meadows and shrublands. Wetland plant communities occupy silted-in beaver ponds and are mostly an intermixture of *Carex utriculata* (Beaked Sedge) and *Calamagrostis canadensis* (Bluejoint Reedgrass). Patches of *Eleocharis palustris* (Common Spikerush) with *Carex canescens* (Hoary Sedge) occupy some small depressions. Willows are common on old dams and around some pond margins, but have suffered high beaver-caused mortality, although many individuals have stump-sprouted. *Alnus incana* (Mountain Alder) and *Salix drummondiana* (Drummond's Willow), along with sapling-sized *Picea engelmannii* (Engelmann Spruce) and *Pinus contorta* (Lodgepole Pine), are colonizing some *Carex utriculata* sedge meadows.

Key Environmental Factors

Past beaver activity has greatly affected vegetation structure and composition at the site, both by creating many small impoundments and by causing significant willow mortality.

Rarity

One G3 community, *Alnus incana* / Mesic Graminoids (Mountain Alder / Mesic Graminoids), was documented in excellent condition.

Land Use

This wetland is fairly remote and no human use of the area was observed.

Exotics

No exotic species were documented at this site.

Uplands

Uplands are intact native subalpine forest.

Plant Community Information

Plant Association / Dominance Type	Rarity Ranks		Viability Rank	EO? (Y/N)
	State	Global		
<i>Alnus incana</i> / Mesic Graminoids Shrubland	*	G3	A	N
<i>Calamagrostis canadensis</i> Western Herbaceous Vegetation	S4	G4	A	N
<i>Carex utriculata</i> Herbaceous Vegetation	S5	G5	A	N
<i>Eleocharis palustris</i> Herbaceous Vegetation	S5	G5	A	N

* Rank not assigned

Three Forks

Directions

Note: this site is located on private land, and landowner permission is required to access this site. This wetland is located in the valley bottom of the Jefferson River. From Three Forks, travel west on U.S. Highway 10 for approximately 1.5 miles. The site lies to the south of the road.

Description

This site consists of a shallow meandered wetland with silty clay loam soils. Dominant species are *Carex simulata* (Short-Beaked Sedge) and *Agrostis stolonifera* (Redtop). Common species include *Muhlenbergia richardsonis* (Mat Muhly), *Glycyrrhiza lepidota* (American Licorice), *Astragalus robbinsii* (Robbins' Milk-Vetch), and *Symphyotrichum falcatum* (Rough White Prairie Aster).

Key Environmental Factors

The site's hydrology maintains these wetlands.

Rarity

This site supports one small population of *Spiranthes diluvialis* (Ute Ladies'-Tresses; S2 / G2, federally listed threatened). Bald Eagles (*Haliaeetus leucocephalus*; S3B,S3N / G4, federally listed threatened) nest along the Jefferson River adjacent to the site.

Land Use

The landowner sometimes irrigates this site to increase productivity.

Exotics

No exotics were noted.

Uplands

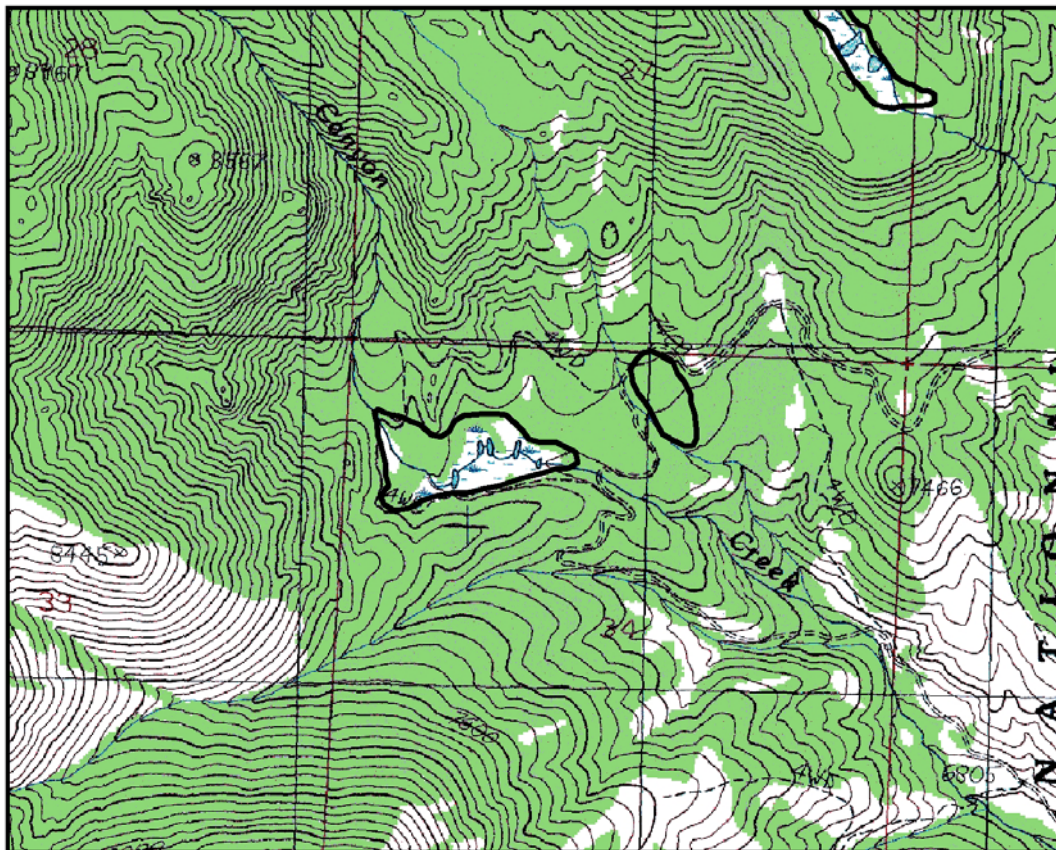
The site is bordered by generally more intensively used range and haylands. There is also some residential development associated with the town of Three Forks.

Plant Community Information

Plant Association / Dominance Type	Rarity Ranks		Viability Rank	EO? (Y/N)
	State	Global		
<i>Carex simulata</i> Herbaceous Vegetation	S3	G4	*	N

* Rank not assigned

Upper Hells Canyon



Directions

This site is located on the southern flank of the Highland Mountains in southwestern Montana. From Twin Bridges, travel north on State Route 41 for approximately 6.5 miles. Just after crossing the Jefferson River, turn south on Forest Route 125. Travel along this road for about 12 miles to the Hells Canyon Guard Station. From the Station, continue up Hells Canyon Creek on Forest Route 9311 for about 2 miles to the site.

Description

This site occurs along an upper reach of Hells Canyon Creek in an area underlain by pre-Belt gneiss and schist. These wetlands have been influenced by past beaver activity and are an intermixture of small patches of sedge and wet meadows and spruce stands. Much of the site is characterized by small patches of open *Picea engelmannii* / *Equisetum arvense* (Engelmann Spruce / Field Horsetail) and *Picea engelmannii* / *Calamagrostis canadensis* (Engelmann Spruce / Bluejoint Reedgrass) communities interspersed with stands of *Carex utriculata* (Beaked Sedge) and *Calamagrostis canadensis*. Some *Picea engelmannii* / *Calamagrostis canadensis* stands have a significant *Populus tremuloides* (Quaking Aspen) component. Many sapling-sized spruce are scattered throughout these wetter herbaceous communities. Many of these herbaceous communities contain beaver-killed willows. There is also a drier meadow dominated by a *Deschampsia caespitosa* (Tufted Hair Grass) community. There are small patches of a *Picea engelmannii* / *Carex scopulorum* (Engelmann Spruce / Holm's Rocky Mountain Sedge) community that forms discontinuous patches around seepy groundwater discharge areas. It has a sparse shrub layer

of *Vaccinium scoparium* (Grouse Whortleberry) and *Ledum glandulosum* (Labrador Tea) over a patchy sward of *Carex scopulorum*. Forbs, such as *Senecio triangularis* (Arrow-Leaf Ragwort), *Arnica cordifolia* (Heart-Leaf Arnica), *Listera cordata* (Heart-Leaf Twayblade), and *Streptopus amplexifolius* (Twistedstalk), are uncommon throughout and largely restricted to drier microsites.

Key Environmental Factors

Past beaver activity has greatly affected vegetation structure and composition at the site, both by creating many small impoundments and by causing significant willow mortality. Hydrologic inputs from both stream surface water and groundwater discharge are important factors in maintaining the character of this site.

Rarity

The *Picea engelmannii* / *Carex scopulorum* (Engelmann Spruce / Holm's Rocky Mountain Sedge; G3) community has not been previously documented in the state. The stands documented at this site match well the description of this community based on plots from the northeastern Cascades and Selkirks of Washington.

Land Use

The site is lightly to moderately grazed by livestock, and some of the spruce stands have been logged, although not recently.

Exotics

Taraxacum officinale (Common Dandelion) was present although not common in drier portions of the site.

Uplands

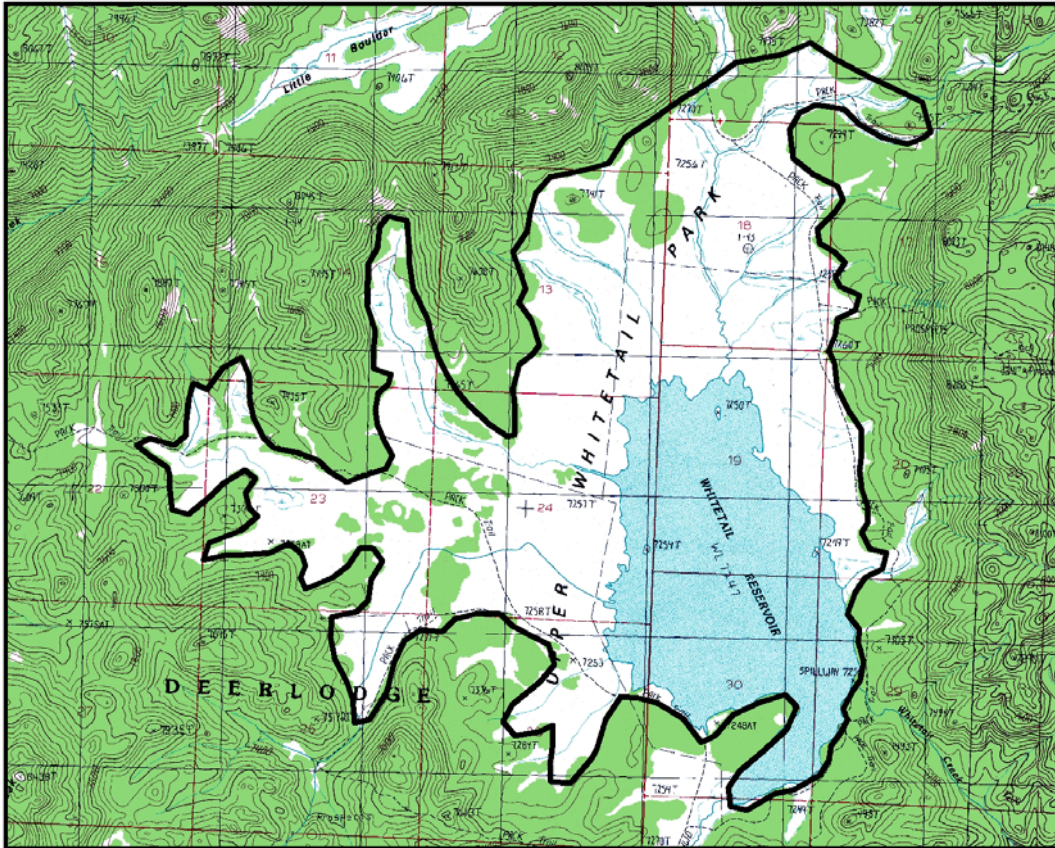
Many of the surrounding uplands have been logged. Recent forestry activities appear to be limited to thinning operations.

Plant Community Information

Plant Association / Dominance Type	Rarity Ranks		Viability Rank	EO? (Y/N)
	State	Global		
<i>Calamagrostis canadensis</i> Western Herbaceous Vegetation	S4	G4	B	N
<i>Carex utriculata</i> Herbaceous Vegetation	S5	G5	B	N
<i>Picea engelmannii</i> / <i>Equisetum arvense</i> Forest	S4	G4	B	N
<i>Picea engelmannii</i> / <i>Calamagrostis canadensis</i> Forest	S4	G4	B	N
<i>Picea engelmannii</i> / <i>Carex scopulorum</i> Woodland	*	G3	B	Y

* Rank not assigned

Upper Whitetail Park



Directions

This site is located in the Boulder Mountains of southwestern Montana. From Boulder, travel southwest up the Little Boulder River on Forest Route 86 for approximately 11 miles to Little Boulder Park. Take Forest Trail 144 southeast for about 1.5 miles to Upper Whitetail Park.

Description

This wetland is a large park of mesic to saturated montane meadows. It also includes open water created by the impoundment of Whitetail Creek. The resulting Whitetail Reservoir occupies much of the southeastern portion of the site. Drier portions of the site are moist meadows dominated by *Deschampsia caespitosa* (Tufted Hairgrass). A soil pit in this community revealed 5 cm of peat over 13 cm of black silty clay loam overlaying yellowish-brown loamy sand with common and distinct redoximorphic features. Although grazed by elk and cattle, *Deschampsia caespitosa* cover is abundant. Other common species in this community include *Carex scopulorum* (Holm's Rocky Mountain Sedge), *Juncus hallii* (Hall's Rush), *Polygonum bistortoides* (American Bistort), and *Camassia quamash* (Common Camas).

Wetter portions of the site include areas that are usually saturated throughout the growing season and include communities dominated by various sedge species, including *Carex aquatilis* (Water Sedge), *Carex simulata* (Short-Beaked Sedge), and *Carex utriculata* (Beaked Sedge). In places there are inclusions of a low *Salix planifolia* / *Carex aquatilis* (Plane-Leaf Willow / Water Sedge) community. Soils in these wetter areas have a 20 cm histic horizon overlaying black silty clay loam. At 45 cm soils are gleyed loamy sand.

Key Environmental Factors

A high groundwater table has created the saturated conditions that have led to the development of the wetland communities at this site.

Rarity

No rare plants, animals, or plant communities were documented at this site.

Land Use

This site receives moderate grazing pressure from both domestic livestock and wild ungulates, such as elk and moose.

Exotics

Exotic species, such as *Taraxacum officinale* (Common Dandelion) and *Trifolium repens* (White Clover), occur only incidentally at this site.

Uplands

Current management of the uplands appears to be minimal. There are several historic mines in the vicinity of the site.

Plant Community Information

Plant Association / Dominance Type	Rarity Ranks		Viability Rank	EO? (Y/N)
	State	Global		
<i>Carex aquatilis</i> Herbaceous Vegetation	S4	G5	A	Y
<i>Carex simulata</i> Herbaceous Vegetation	S3	G4	A	Y
<i>Deschampsia caespitosa</i> Herbaceous Vegetation	S4	G4	A	Y
<i>Salix planifolia</i> / <i>Carex aquatilis</i> Shrubland	S3	G5	A	Y

APPENDIX C. SITE EVALUATION CRITERIA

Site Rank Criteria for Wetlands and Riparian Areas

Rank Procedure: The following site ranking specifications have been modified from and informed by criteria presented in regional wetland assessment protocols (Washington State Department of Ecology 1991, Chadde et al. 1998, Greenlee 1999, Jankovsky-Jones 1999), hydrogeomorphic functional assessments (Hruby et al. 1999, Jankovsky-Jones et al. 1999a, 1999b, Hauer et al. 2000a, 2000b, Hruby et al. 2000), and plant community ranking specifications developed by other Natural Heritage programs (Chappell and Christy 2000, Rondeau and Sanderson 2000). This ranking procedure has been developed to be consistent with standard Heritage methodology described in the Draft Element Occurrence Data Standard (TNC and ABI 1999). The data standard was developed for ranking an element occurrence's viability by evaluating its condition, landscape context, and size. We propose similar criteria to evaluate a wetland site's viability. In addition to condition, context, and size, two other factors important in determining a site's conservation significance, diversity and rarity, are considered.

In the Rocky Mountains and Great Plains of Montana, wetlands occur as small patch and linear systems on the landscape (although there may be localized large patch occurrences, as in the Centennial Valley). Because of their small size and high dependence on external processes, the primary factors affecting site viability and significance are condition and context. Secondary factors are diversity and rarity, and the tertiary factor is size. These variables, their weighting factors, and rank thresholds are described below.

Condition Specifications (weight factor = .25): This factor is a combination of environmental factors (hydrologic, geomorphic, and biogeochemical) and vegetation and habitat parameters. A site's condition should be representative of the overall condition of individual plant associations present at the site. In addition to the condition of native plant associations, the presence of exotic-dominated communities is an important factor. The presence of weedy, modified, or cultural vegetation types should reduce the site condition rank, even where native associations are in pristine condition. An important point to consider in this case is the potential for the exotic species to spread. Note: not all of the factors listed below are applicable to all wetland systems (e.g., surface flooding is primarily a process associated with riverine systems, whereas subsurface flooding/saturation is important for all wetland types).

The following rank thresholds are not mutually exclusive. It is possible to have a site with minor hydrologic or geomorphic modification with highly degraded plant communities. For example, a cottonwood stand with an exotic-dominated understory along a free-flowing river (hydrology and geomorphology rank of A or B, vegetation and habitat rank of D) would warrant an overall condition rank of C.

A-rated condition

Hydrology, geomorphology, and biogeochemistry. Natural hydrologic processes are intact and the site has no geomorphic modifications. Indicators include:

- In all systems, subsurface flooding and saturation of low areas (swales, oxbows, old channels, depressions) occurs in most years as indicated by soils, vegetation, photographs.
- Overbank flooding occurs regularly (approximately every other year or more frequently) as indicated by soils, vegetation, photographs. This factor is important primarily for riverine systems with well developed floodplains.
- The floodplain is being actively developed, with multiple macrotopographic features present (e.g., oxbows, overflow/abandoned channels, floodplain, terraces, bars).
- Stream banks and channels have representative shape, are not riprapped, and are not unvegetated by excessive grazing or trampling.
- There is no evidence of geomorphic modification, excessive erosion, sediment deposition, or nutrient loading.

Vegetation and habitat

- Plant communities have representative structure and composition (e.g., cottonwood stands have a diverse and well developed shrub component).
- Regeneration is occurring and seedlings, saplings, or clonal shoots are present. In riverine floodplain systems, channel bar formation is creating substrate for woody vegetation colonization (this may be occurring in the system though not at the site).
- There is a high level of interspersed and connectivity among plant communities.
- Within native plant communities, no or very few exotic species are present, with no potential for expansion. Cultural or modified vegetation types are absent or are a very minor component of the site.

B-rated condition

Hydrology, geomorphology, and biogeochemistry. Hydrologic and geomorphic modifications are minimal and/or localized and are easily restorable. Indicators include:

- Overbank and subsurface flooding still occurs frequently, but flooding regimes may be slightly modified by irrigation withdrawal, small headwaters dams, or localized and minimal geomorphic alteration (roads, bridges, ditching, diking, bank revetment, soil compaction, clearing).
- Floodplain riverine systems have few macrotopographic features, but there is evidence of recent floodplain development.
- Stream banks may show some local adverse effects from excessive grazing or other activity.
- Any excessive erosion, deposition, or nutrient loading is restricted to localized pockets.

Vegetation and habitat

- Native plant community structure and composition has been somewhat altered by logging, grazing (including browse from native ungulates), fire suppression, etc. (e.g., the native shrub component is structurally and compositionally diverse, but browsing pressure has altered the structure and abundance, especially that of palatable species).
- Native species that increase with disturbance or changes in hydrology or nutrients are restricted to microsites.
- Limited regeneration and channel bar formation is occurring.
- There is a moderate level of interspersed and connectivity among plant communities.
- Exotic species and cultural vegetation are a minor component of the site and have little potential for expansion.

C-rated condition

Hydrology, geomorphology, and biogeochemistry. Hydrologic and geomorphic modifications are more systematic, and require either a long time (decades) or significant effort to restore.

Indicators include:

- Subsurface flooding or saturation occurs relatively frequently, but overbank flooding occurs only during high floods. Hydrologic or geomorphic modifications have systematically altered the hydrologic regime. Modifications include regional hydropower or flood control dams, extensive irrigation withdrawals or return flows, widespread ditching, moderate bank revetment, etc.
- Floodplain riverine systems have few macrotopographic features and there is no evidence of recent floodplain development.
- Stream banks are significantly altered by excessive grazing, bank stabilization, channelization, road construction, etc.
- Excessive erosion, deposition, or nutrient loading is common.

Vegetation and habitat

- Native plant community structure and composition has been substantially altered by logging, grazing (including browse from native ungulates), fire suppression, etc.
- Native species that increase with disturbance or changes in hydrology or nutrients are widespread.
- Native species regeneration is not occurring or very restricted; no evidence of woody species colonization of channel bars.
- There is a low level of interspersal and connectivity among plant communities.
- Exotic species and cultural vegetation are widespread but potentially controllable.

D-rated condition

Hydrology, geomorphology, and biogeochemistry. Hydrology and geomorphology are significantly altered at both local and regional scales; restoration is unlikely.

- Surface/subsurface flooding occurs only during extreme flood events.
- Geomorphic modifications are extensive and a significant proportion of the channel is revetted.
- Stream banks are severely degraded.

Vegetation and habitat

- Community structure and composition is significantly affected by exotic species (e.g., understories of cottonwood stands have been converted from native shrubs or grasses to exotic graminoids).
- Native plant communities are fragmented by cultural vegetation.
- Exotic species, cultural vegetation, or native increasers are dominant and restoration is unlikely.

Landscape Context Specifications (weight factor = .25): This factor is a composite of context ranks for individual plant associations present at the site. The site context should be representative of the overall landscape context of these communities.

A-rated context

The site's hydrologic regime is not altered by flow regulation, augmentation, or reduction by upstream reservoirs, groundwater pumping, or irrigation withdrawal. Site is connected hydrologically and by suitable habitat (e.g., riparian vegetation along stream corridors) to other wetlands via unaltered surface or subsurface channels. Native vegetation in good condition occupies a 100-m buffer zone around the wetland. Adjacent uplands and the upstream watershed are unaltered (> 90% natural vegetation) by urban, agricultural, or other landuses (e.g., logging) that might affect hydrology or habitat connectivity. Habitat connectivity allows natural processes and species migration to occur.

B-rated context

Hydrologic regime is largely unaltered with few small reservoirs or irrigation withdrawals upstream. Hydrologic and habitat connectivity still largely intact, but a few barriers or gaps are present. Landuse in the wetland buffer is restricted to light grazing or selective logging. Adjacent uplands and the upstream watershed are moderately altered (60 to 90% natural vegetation) by urban, agricultural, or other uses.

C-rated context

Natural hydrological regimes are altered by upstream reservoirs or irrigation practices. Hydrologic connections are functional, but habitat connections are fragmented and multiple barriers are present. Landuse in the wetland buffer includes moderate grazing, logging, or haying. Adjacent uplands and upstream watershed are fragmented (20-60% natural vegetation) by urban, agricultural, or other uses.

D-rated context

Hydrology substantially altered by upstream reservoirs or irrigation practices (e.g., stream may go completely dry in most years, marsh may experience complete drawdown). Site may be hydrologically isolated due to hydrological or geomorphological modifications. Wetland buffer is heavily grazed, roaded, or tilled. Habitat is extremely fragmented and adjacent uplands and upstream watershed are largely converted to urban, agricultural, or other uses.

Diversity Specifications (weight factor = .20): This factor has three components: floristic diversity (measured by number of plant associations), plant physiognomic diversity (measured by number of Cowardin classes/subclasses), and geomorphic diversity (measured by Cowardin water regimes). Cowardin classes are forest-evergreen, forest-deciduous, scrub-shrub, emergent, and aquatic bed. Cowardin water regimes include temporarily flooded, seasonally flooded, semipermanently flooded, and permanently flooded. Each component is considered separately, and the overall rank is the average score of the three components. Each component is weighted equally. To be counted, each component should occupy or occur over at least 10% of the site or 0.5 acres.

A-rated diversity

4 or more plant communities; 4 or more Cowardin classes; 4 or more Cowardin water regimes.

B-rated diversity

3 plant communities; 3 Cowardin classes; 3 Cowardin water regimes.

C-rated diversity

2 plant communities; 2 Cowardin classes; 2 Cowardin water regimes.

D-rated diversity

1 plant community; 1 Cowardin class; 1 Cowardin water regime.

Rarity Specifications (weight factor = .20): This factor is evaluated by the number and condition of rare or imperiled plants, animals, or communities present at the site. Sites with no rare elements as described below rank 0 for this factor. Peatlands are automatically ranked at A-level rarity.

A-rated rarity

One A-ranked G1 occurrence, four or more A or B-ranked G1 or G2 occurrences, four or more A-ranked G3 occurrences, or peatland associations form a significant component of the site.

B-rated rarity

One B through D-ranked G1 occurrence, one A or B-ranked G2 occurrence, one A-ranked G3 occurrence, or four or more B-ranked G3 or C-ranked G2 occurrences.

C-rated rarity

One C or D-ranked G2 occurrence, one B-ranked G3 occurrence, or four or more A or B-ranked S1 (G4 or G5) occurrences.

D-rated rarity

One C-ranked G3 occurrence, one A or B-ranked S1 (G4 or G5) occurrence, one A-ranked S2 (G4 or G5) occurrence, or four or more B-ranked S2 (G4 or G5) or A-ranked S3 (G4 or G5) occurrences.

Size Specifications (weight factor = .10): This factor will vary depending on the type of wetland being evaluated (e.g., slope, depressional, riverine, lacustrine fringe). If site boundaries are defined by land ownership or similar factors, evaluate this factor based on the size of the site's ecological boundaries. Minimum site size is 1 acre (0.5 acre for peatlands).

A-rated size

> 100 acres for riverine; > 50 acres for slope, depressional, or lacustrine fringe; > 10 acres for peatland

B-rated size

50 to 100 acres for riverine; 25 to 50 acres for slope, depressional, or lacustrine fringe; 5 to 10 acres for peatland

C-rated size

10 to 50 acres for riverine; 5 to 25 acres for slope, depressional, or lacustrine fringe; 1 to 5 acres for peatland

D-rated size

< 10 acres for riverine; < 5 acres for slope, depressional, or lacustrine fringe; < 1 acre for peatland

Calculating Site Ranks: To calculate the overall site rank, the A – D ranks for each factor are given numeric equivalents, such that A = 4, B = 3, C = 2, and D = 1. These numeric equivalents are then multiplied by the weighting assigned to each factor and then added together, as illustrated by the following formula:

$$(R_{\text{cond}} * w_{\text{cond}}) + (R_{\text{cont}} * w_{\text{cont}}) + (R_{\text{div}} * w_{\text{div}}) + (R_{\text{rare}} * w_{\text{rare}}) + (R_{\text{size}} * w_{\text{size}}) = \text{overall site rank}$$

where R_{cond} = numeric equivalent for condition rank
 R_{cont} = numeric equivalent for landscape context rank
 R_{div} = numeric equivalent for diversity rank
 R_{rare} = numeric equivalent for rarity rank
 R_{size} = numeric equivalent for size rank

and w_{cond} = weight factor for condition
 w_{cont} = weight factor for landscape context
 w_{div} = weight factor for diversity
 w_{rare} = weight factor for rarity
 w_{size} = weight factor for size

The overall site rank is then determined given the following correspondence:

<u>Site Rank</u>	<u>Numeric Range</u>
A	>3.25 and ≤4.00
B	>2.50 and ≤3.25
C	>1.75 and ≤2.50
D	>0.80 and ≤1.75

For example, a site with B-ranked condition, A-ranked landscape context, C-ranked diversity, D-ranked rarity, and C-ranked size would have an overall site rank of B, as illustrated below:
 $(3 * 0.25) + (4 * 0.25) + (2 * 0.20) + (1 * 0.20) + (2 * 0.10) = 2.55$

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APPENDIX D. PLANT COMMUNITY DESCRIPTIONS

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I. FOREST

PICEA ENGELMANNII SATURATED FOREST ALLIANCE Englemann Spruce Saturated Forest Alliance

ALLIANCE CONCEPT

Summary: The vegetation in this alliance occurs in riparian areas in northwestern Montana. The climate regime is maritime; moist air masses from the Pacific Ocean release large amounts of snow and rain. Summers are warm and dry as dry air masses move across western Montana. Afternoon thunderstorms are common. Stands are located in low-elevation (880-900 m) valleys adjacent to meandering streams and ponds. Stands are found on level sites that have a high water table; the water table is usually within 50 cm of the soil surface throughout the year. Standing water is present in depressions. Soils are poorly drained and have a high organic matter content in the upper horizon. *Picea engelmannii* and hybrid swarms of *Picea* (a result of its hybridization with *Picea glauca*, a common lower elevation condition) dominate a moderately open tree canopy. *Betula papyrifera* is occasionally present. A number of shrub species occur in the understory; the most common species are *Alnus incana*, *Betula occidentalis*, and *Cornus sericea*. The herbaceous layer is dominated by the forb *Lysichiton americanus*. *Cinna latifolia* and *Athyrium filix-femina* are common associates, but occur in low abundances. *Carex* spp., *Phalaris arundinacea*, *Typha latifolia*, and *Salix* spp. dominate adjacent riparian communities.

Environment: The vegetation in this alliance occurs in riparian areas in northwestern Montana. The following is based on Hansen et al. (1995). The climate regime is maritime during the winter and spring when moisture air masses from the Pacific Ocean release large amounts of snow and rain. Summers are warm and dry as dry air masses move across western Montana. Afternoon thunderstorms are common. Stands are located in low-elevation (880-900 m) valleys adjacent to meandering streams and ponds. Stands are found on level sites that have a high water table; the water table is usually within 50 cm of the soil surface throughout the year. Standing water is present in depressions. Soils are poorly drained and have a high organic matter content in the upper horizon. Adjacent riparian communities are dominated by *Carex* spp., *Phalaris arundinacea*, *Typha latifolia*, and *Salix* spp.

Vegetation: The vegetation in this alliance occurs in riparian areas in northwestern Montana. The association of *Picea engelmannii* and hybrid swarms of *Picea* (a result of its hybridization with *Picea glauca*, a common lower elevation condition) is found in wetland areas in Montana. A moderately open canopy of *Picea* spp. dominates the tree canopy. *Betula papyrifera* is occasionally present. A number of shrub species occur in the understory; the most common species are *Alnus incana*, *Betula occidentalis*, and *Cornus sericea*. The herbaceous layer is dominated by the forb *Lysichiton americanus*. *Cinna latifolia* and *Athyrium filix-femina* are common associates, but occur in low abundances.

Dynamics: The presence of the vegetation in this alliance corresponds roughly with the Inland Maritime climatic regime, but the driving variable of greatest importance is permanent soil saturation (spring flooding common).

Comments: The association of *Picea engelmannii* and hybrid swarms of *Picea* (a result of its hybridization with *Picea glauca*, a common lower elevation condition) with wetland conditions is well known in Montana.

ALLIANCE SOURCES

Authors: M. DAMM, West **Identifier:** A.204

References: Hansen et al. 1991, Hansen et al. 1995

PICEA ENGELMANNII / CALAMAGROSTIS CANADENSIS FOREST Englemann Spruce / Bluejoint Forest

ELEMENT CONCEPT

Summary: This forest plant association occurs on cool, moist sites at low to high elevations in the Rocky Mountains of Montana, Wyoming, and southeastern Idaho. It is generally restricted to flat to gently sloping sites with poor drainage, such as fen and lake margins, toeslopes, and low stream and river terraces. This community usually is saturated for a good portion of the year, and stands have a high water table year round. The ground surface in these stands is characterized by a large amount of microtopography stemming from windthrown trees. The overstory is dominated by *Picea engelmannii* or *Picea (engelmannii X glauca)* hybrids, and *Abies lasiocarpa* may also be present. Not infrequently *Pinus contorta* is a long-persisting seral component. Shrub canopy coverage is low, although the diversity of shrub species present is fairly high. *Calamagrostis canadensis* and *Calamagrostis stricta* are diagnostic species when well represented; usually under these shaded forest conditions *Calamagrostis canadensis* dominates the ground layer, often forming what appears to be a pure grass sward.

Synonymy:

- *Picea engelmannii*/*Calamagrostis canadensis* (Bourgeron and Engelking 1994) =
- *Picea* spp. / *Calamagrostis canadensis* community type (Hansen et al. 1995). in Montana.
- *Picea* / *Calamagrostis canadensis* community type (Youngblood et al. 1985a)

- Conifer / *Calamagrostis canadensis* (Padgett et al. 1989). a few Utah stands have a *Picea engelmannii*-dominated overstory.

GRank & Reasons: G4 (00-01-18). This type is the result of merging two associations, with ranks of G3 and G4, resulting in a rank of G4 for this newly defined type. There are a moderate number of estimated occurrences of this community across its range, and apparently the specific hydrologic and geomorphic conditions required for this community are uncommon. Timber harvest has occurred in this community in the past, and this will likely continue; opening the canopy can leave remaining trees (shallowly-rooted) susceptible to blowdown. However, other threats such as exotic species and development are relatively low.

Comments: Former *Picea (engelmannii X glauca, engelmannii) / Calamagrostis canadensis* Forest (CEGL000404) in Montana has been merged with the former *Picea engelmannii / Calamagrostis canadensis* Forest (CEGL000356) into a single entity which can include pure *Picea engelmannii* and *Picea engelmannii X glauca* hybrids, or both. This type was described in Montana as the *Picea* spp. / *Calamagrostis canadensis* community type by Hansen et al. (1995). The authors explain that the frequent absence of cones and similar morphology and ecological amplitudes caused them to lump stands dominated by *Picea engelmannii* and *Picea glauca* (hybrids) into a single type. Youngblood et al. (1985a) also describe a *Picea / Calamagrostis canadensis* community type; these authors explain that the similar ecological amplitudes lead them to lump *Picea engelmannii* and *Picea pungens* into a single type. A few Utah stands (Padgett et al. 1989), classified as Conifer / *Calamagrostis canadensis*, have a *Picea engelmannii*-dominated overstory.

ELEMENT DISTRIBUTION

Range: This forest plant association occurs on cool, moist sites at low to high elevations in the Rocky Mountains of Montana, Wyoming, and southeastern Idaho.

Nations: US

States/Provinces: ID:S4, MT:S4, WY:S3

ELEMENT SOURCES

Authors: J. Greenlee, WCS **Confidence:** 1 **Identifier:** CEGL002678

References: Boggs et al. 1990, Bourgeron and Engelking 1994, Hansen et al. 1995, Jankovsky-Jones 1997, Padgett et al. 1989, Youngblood et al. 1985a, Zuck 1974

POPULUS TREMULOIDES FOREST ALLIANCE Quaking Aspen Forest Alliance

ALLIANCE CONCEPT

Summary: Forests in this alliance are found on rolling topography such as the glacial moraines in Minnesota or the Turtle Mountains and Pembina Hills of North Dakota, often occurring between grasslands and other forest types. The soils are usually deep, well-developed, and loamy. Stands in this alliance often originate following disturbance. This alliance is widespread in the western United States, the northern Great Plains, and extends into the western Great Lakes area. The dominant species of the canopy is *Populus tremuloides*. In the midwestern United States, *Quercus macrocarpa* and *Betula papyrifera* are common associates and can even be codominant in some stands. The shrub layer can be made up of several shrubs common to the Great Plains, including *Corylus cornuta*, *Corylus americana*, *Prunus virginiana*, *Symphoricarpos occidentalis*, *Amelanchier alnifolia*, and *Rubus* spp. In wetter stands *Cornus* spp. and *Salix* spp. may also be present. The herbaceous layer may contain *Aralia nudicaulis*, *Carex pensylvanica*, *Maianthemum canadense*, *Maianthemum stellatum*, *Viola* spp., and *Thalictrum dioicum*. In the western United States common associates include *Acer glabrum*, *Amelanchier alnifolia*, *Symphoricarpos oreophilus*, *Bromus carinatus*, *Calamagrostis rubescens*, *Thalictrum fendleri*, *Carex siccata* (= *Carex foenea*), *Carex geyeri*, *Carex rossii*, and *Hesperostipa comata* (= *Stipa comata*). In the Dakotas and Wyoming, these stands may remain successional stable for many dozens of years, while in the more mesic, eastern portion of the range, *Populus tremuloides* forests succeed to other community types much more quickly. *Populus tremuloides* (the species) reaches Texas, Virginia, and West Virginia, but it is unclear whether *Populus tremuloides* communities occur in any of these states. Stands of *Populus tremuloides* in the Trans-Pecos of western Texas occur in ravines and on open talus slopes above 2134 m (7000 feet) elevation; they may best be treated as *Populus tremuloides* communities, or merely as other communities with a component of aspen. Texas stands of *Populus tremuloides* are of limited extent and variable in structure.

Environment: Forests included in this alliance occur extensively in the western U.S., northern Great Plains and extend into the western Great Lakes area. Elevations range from 900-3350 m. Climate is temperate with a relatively long growing season, typically cold winters and often deep snow. Mean annual precipitation is greater than 38 cm and typically greater than 50 cm, except in semi-arid environments where stands are restricted to mesic microsites such as seeps or large snow drifts. Distribution of these forests is primarily limited by adequate soil moisture required to meet its high evapotranspiration demand (Mueggler 1988). Secondly, its range is limited by the length of the growing season or low temperatures (Mueggler 1988). Topography is variable, sites range from level to steep slopes. Aspect varies according to the limiting factors. Stands at high elevations or northern latitudes are restricted by cold temperatures and are found on warmer southern aspects. At lower elevations or southern latitudes stands are restricted by lack of moisture and are found on cooler north

aspects and mesic microsites. The soils are typically deep and well-developed with rock often absent from the soil. Soil texture ranges from sandy loam to clay loams. Parent materials are variable and may include sedimentary, metamorphic or igneous rocks, but it appears to grow best on limestone, basalt, and calcareous or neutral shales (Mueggler 1988).

Geography strongly influences this type. In the western U.S., stands occur on mesic upland sites and stream terraces above the floodplain. In the Rocky Mountains, a band of this type occurs at the lower treeline from the plains to toe slopes and slumps. In the Great Basin and southwestern US. and the annual precipitation is typically low and stands are found in areas where subsurface soil moisture accumulates or where temperature and evaporation rates are lower such as in swales and canyons, below seeps, and on north aspects of slopes at higher elevations. Stands of *Populus tremuloides* in the Trans-Pecos of western Texas occur in ravines and on open talus slopes above 2135 m. In the northern Great Plains, these forests are typically found on rolling topography such as the glacial moraines in Minnesota or the Turtle Mountains and Pembina Hills of North Dakota (Potter and Moir 1961, MNNHP 1993). They are often on the prairie-forest border between grasslands and other forest types from northern Minnesota to Iowa (Hoffman and Alexander 1987, MNNHP 1993).

Vegetation: Vegetation included in this widespread forest alliance occurs in the western U.S., northern Great Plains and extends into the western Great Lakes area. Stands have a somewhat closed to closed canopy of trees to 5-20 m tall, that is dominated or codominated by the cold-deciduous broad-leaved tree *Populus tremuloides*. Other broad-leaved trees such as *Populus balsamifera* ssp. *trichocarpa*, *Quercus macrocarpa*, and *Betula papyrifera* may be present to codominant depending on geography and topography. Several species of conifer trees may also be present in the tree canopy. Conifers include *Abies concolor*, *Abies lasiocarpa*, *Picea engelmannii*, *Picea pungens*, *Pinus contorta*, *Pinus ponderosa*, and *Pseudotsuga menziesii*. Conifer species may contribute up to 25% of the tree canopy before the stand is reclassified as a mixed stand. Because of the open growth form of *Populus tremuloides* enough light can penetrate for lush understory development. Depending on available soil moisture and other factors like disturbance, the understory structure may be complex with multiple shrub and herbaceous layers, or simple with just a herbaceous layer. The herbaceous layer may be dense or sparse, dominated by graminoids or forbs.

In the western U.S. common tree associates include *Populus balsamifera* ssp. *trichocarpa* in the northern Rocky Mountains (Cooper and Heidel 1997). Scattered conifer trees such as *Pseudotsuga menziesii* and species of *Pinus*, *Picea*, *Abies* may also be present. Common shrubs include *Acer glabrum*, *Amelanchier alnifolia*, *Artemisia tridentata*, *Juniperus communis*, *Prunus virginiana*, *Rosa woodsii*, *Shepherdia canadensis*, *Symphoricarpos oreophilus* and the dwarf-shrubs *Mahonia repens* and *Vaccinium myrtillus*. The herbaceous layers may be lush and diverse. Common graminoids may include *Bromus carinatus*, *Calamagrostis rubescens*, *Carex siccata* (= *Carex foenea*), *Carex geyeri*, *Carex rossii*, *Elymus glaucus*, *Elymus trachycaulus*, *Festuca thurberi*, and *Hesperostipa comata* (= *Stipa comata*). Associated forbs may include *Achillea millefolium*, *Eucephalus engelmannii* (= *Aster engelmannii*), *Delphinium X occidentale*, *Geranium viscosissimum*, *Heracleum sphondylium*, *Ligusticum filicinum*, *Lupinus argenteus*, *Osmorhiza berteroi* (= *Osmorhiza chilensis*), *Pteridium aquilinum*, *Rudbeckia occidentalis*, *Thalictrum fendleri*, *Valeriana occidentalis*, *Wyethia amplexicaulis* and many others. Exotic grasses such as the perennial *Poa pratensis* and the annual *Bromus tectorum* are often common in stands disturbed by grazing.

In the midwestern United States, these forests are found along the prairie-forest border from northern Minnesota to Iowa. *Quercus macrocarpa* and *Betula papyrifera* are common associates and are codominant in some stands. Scattered *Fraxinus pennsylvanica*, *Populus balsamifera*, *Quercus ellipsoidalis*, *Tilia americana*, and *Ulmus americana* may also be present. The shrub layer can be made up of several shrubs common to the Great Plains, including *Corylus cornuta*, *Corylus americana*, *Prunus virginiana*, *Symphoricarpos occidentalis*, *Amelanchier alnifolia*, *Viburnum opulus* var. *americanum* (= *Viburnum trilobum*), and *Rubus* spp. In wetter stands *Cornus* spp. and *Salix* spp. may also be present. The herbaceous layer may contain *Aralia nudicaulis*, *Carex pensylvanica*, *Maianthemum canadense*, *Maianthemum stellatum*, *Sanicula marilandica*, *Oryzopsis asperifolia*, *Schizachne purpurascens*, *Viola* spp., and *Thalictrum dioicum*.

Populus tremuloides (the species) reaches Texas, Virginia, and West Virginia, but it is unclear whether *Populus tremuloides* communities occur in any of these states. Texas stands of *Populus tremuloides* are of limited extent and variable in structure. More study is needed to determine this.

Dynamics: Stands in this alliance often originate, and are likely maintained, by stand-replacing disturbances such as crown fire, disease and windthrow, or clear-cutting by man or beaver. The stems of these thin-barked, clonal trees are easily killed by ground fires, but they can quickly and vigorously resprout in densities of up to 30,000 stems per hectare (Knight 1993). The stems are relatively short-lived (100-150 years), and the stand will succeed to longer-lived conifer forest if undisturbed. Stands are favored by fire in the conifer zone (Mueggler 1988). With adequate disturbance a clone may live many centuries. Although *Populus tremuloides* produces abundant seeds, seedling survival is rare because of the long moist conditions required to establish are rare in the habitats that it occurs in. Superficial soil drying will kill seedlings (Knight 1994). In the Dakotas and Wyoming, these stands may remain successional stable for many dozens of years (Girard et al. 1989). In the more mesic areas of the eastern segment of its range, they succeed to other community types much more quickly (MNNHP 1993).

Comments: This alliance is floristically similar to other forest alliances that are dominated by *Populus tremuloides* alone or in combination with *Betula papyrifera*. Among these are I.B.2.N.e *Populus tremuloides* - *Betula papyrifera* Forest Alliance

(A.269), I.B.2.N.d *Populus tremuloides* Temporarily Flooded Forest Alliance (A.300), and I.C.3.N.a *Picea glauca* - *Abies balsamea* - *Populus* spp. Forest Alliance (A.418). Stands in Texas may best be treated as *Populus tremuloides* communities or merely as other communities with a component of aspen. Texas stands of *Populus tremuloides* are of limited extent and variable in structure. Further information is needed. Stands in Nevada, described by Blackburn et al. (1968a, 1968b, 1971), are restricted to stream terraces, do not have enough tree canopy cover to be classified as forests, and would be better classified as woodlands. More study is needed especially if these sites have a flood regime. Stands in California need association-level description.

ALLIANCE SOURCES

Authors: A.S. WEAKLEY 2-96, MOD. K, JT, West **Identifier:** A.274

References: Alexander 1986, Bader 1932, Baker 1982b, Baker and Kennedy 1985, Blackburn et al. 1968b, Blackburn et al. 1968c, Blackburn et al. 1969b, Blackburn et al. 1969d, Blackburn et al. 1971, Bond 1959, Boyce 1977, Bunin 1975a, Bunin 1975c, Coenenberg and Deput 1979, Cooper and Heidel 1997, Cooper and Pfister 1981, Costello 1954, Cox 1968, Crouch 1983, Curry 1962, DeByle 1985, DeByle 1989, DeByle and Winokur 1985, Dick-Peddie 1993, Dorn 1969, Eyre 1980, Faber-Langendoen et al. 1996, Ferchau 1973, Fike 1999, Giese 1975, Girard et al. 1989, Hansen et al. 1988a, Hansen et al. 1991, Hansen et al. 1995, Hess 1981, Hess and Alexander 1986, Hess and Wasser 1982, Hoffman and Alexander 1976, Hoffman and Alexander 1980, Hoffman and Alexander 1983, Hoffman and Alexander 1987, Holland 1986b, Johnston 1987, Johnston and Hendzel 1985, Keammerer and Peterson 1981, Keammerer and Stoecker 1975, Keammerer and Stoecker 1980, Kittel et al. 1994, Kittel et al. 1996, Kittel et al. 1999a, Knight 1994, Komarkova et al. 1988a, Komarkova et al. 1988b, Langenheim 1962, Lewis 1975, Lynn et al. n.d., MNNHP 1993, MTNHP n.d., Marr et al. 1973a, Marr et al. 1973b, Morgan 1969, Mueggler 1988, Mueggler and Campbell 1982, Mueggler and Campbell 1986, Murphy 1982, Mutel 1976, Palmer 1929, Paulsen 1969, Peet 1975, Peet 1981, Plumb 1988, Potter and Moir 1961, Powell 1988a, Reed 1971, Richard et al. 1996, Rominger and Paulik 1983, Sawyer and Keeler-Wolf 1995, Severson and Thilenius 1976, Shepherd 1975, Shepperd 1990, Smith 1991, Terwilliger et al. 1979a, Wasser and Hess 1982, Williams and Lillybridge 1983, Youngblood and Mueggler 1981

POPULUS BALSAMIFERA SSP. TRICHOCARPA TEMPORARILY FLOODED FOREST ALLIANCE

Black Cottonwood Temporarily Flooded Forest Alliance

ALLIANCE CONCEPT

Summary: This riparian forest alliance occurs on alluvial terraces along major streams and rivers throughout the western United States, west of the Continental Divide. Elevations range from sea level in California to 1800 m. They can occur on alluvial terraces of major streams and rivers, margins of lakes, meadows, deltas, river mouths, and terraces. Stands can occupy broad floodplains or form narrow stringers adjacent to streams with a much steeper slope. Soils typically overlay river gravel and/or cobbles and are coarse-textured. Water tables usually drop below 1 m of the soil surface in summer, but can remain moist due to capillary action. Vegetation within this alliance is characterized by an open to moderately dense tree layer that is dominated by *Populus balsamifera* ssp. *trichocarpa*. Tree associates include *Populus deltoides*, *Populus angustifolia*, *Pinus ponderosa*, *Picea* spp., and *Alnus rhombifolia*, *Alnus rubra*, and *Fraxinus latifolia* in stands along the west coast. A shrub layer is usually present and may be dominated by *Alnus incana*, *Betula papyrifera*, *Cornus sericea*, *Crataegus douglasii*, *Prunus virginiana*, *Ribes americanum*, *Salix exigua*, and *Symphoricarpos albus*. The herbaceous layer is usually relatively sparse and is dominated by either forbs or graminoids. Common species include *Actaea rubra*, *Cicuta douglasii*, *Equisetum sylvaticum*, *Mentha arvensis*, and *Symphotrichum spathulatum* (= *Aster occidentalis*). The graminoid cover is usually less than 10%, but can be up to 80% consisting mainly of introduced hay grasses on disturbed sites. Species information on the graminoid and forb layers is lacking for much of the range of this alliance. Diagnostic of this alliance is the dominance of *Populus balsamifera* ssp. *trichocarpa* in the tree canopy in forests that are briefly flooded during the growing season.

Environment: Vegetation types in this alliance occur on alluvial terraces along major streams and rivers throughout the western United States, west of the Continental Divide. Elevations range from sea level in California to 1800 m. They can occur on alluvial terraces of major streams and rivers, margins of lakes, meadows, deltas, river mouths, and terraces. Stands can occupy broad floodplains (1-3% slopes) or form narrow stringers adjacent to streams with a much steeper slope (10-15%). Soils are typically Entisols, usually up to 1 m of mineral soil overlying river gravel and/or cobbles. Soil texture varies from loam to coarse sand. Water tables usually drop below 1 m of the soil surface in summer, but can remain moist due to capillary action. A fluctuating water table in these soils is evidenced by the common presence of mottles.

Adjacent wetter communities may be dominated by a variety of types including *Salix exigua* and *Salix lucida* ssp. *lasiandra* community types, or the *Typha latifolia*- and *Eleocharis* spp.-dominated habitat types. Adjacent drier communities may be dominated by coniferous or aspen forests.

Vegetation: Vegetation types within this alliance are classified as temporarily flooded forests, but many individual stands have cover less than 60% (see Classification comments). The tree layer is dominated by an open to moderately dense canopy (>50%) of *Populus balsamifera* ssp. *trichocarpa*. *Populus deltoides*, *Populus angustifolia*, *Pinus ponderosa*, and *Picea* spp.

can occur in the canopy with *Populus balsamifera* in the Montana stands. The Oregon, Washington, and California data state that *Alnus rhombifolia*, *Alnus rubra*, and *Fraxinus latifolia* occur in the tree canopy. The shrub layer in the Montana stands typically is dominated by *Cornus sericea*, *Alnus incana*, *Betula papyrifera*, *Prunus virginiana*, and *Ribes americanum*. The Pacific Northwest and California stands contain *Crataegus douglasii*, *Salix exigua*, and *Symphoricarpos albus* in the shrub layer, and the forb *Cicuta douglasii* is common. The forb layer from the Montana stands ranges from 1-20%, dominated by *Actaea rubra*, *Mentha arvensis*, and *Symphotrichum spathulatum* (= *Aster occidentalis*). The graminoid cover is usually less than 10%, but can be up to 80%, and mainly consists of introduced hay grasses. *Equisetum sylvaticum* can dominate the fern layer with up to 40% cover. There was no species information on the graminoid and forb layers for the Pacific Northwest and California types.

Dynamics: *Populus balsamifera* ssp. *trichocarpa* is susceptible to fire during the late summer and fall. This species is adapted to light and in some instances to moderate-intensity fires and may produce new sprouts following burns (Hansen et al. 1995). In Montana, many of these sites are seral to *Picea engelmannii* (including *Picea engelmannii* X *glauca*) and *Thuja plicata* forests.

Comments: This alliance needs review of the woodland versus forest status of the associations within it. Cover of the tree canopy can be highly variable within associations in this alliance, but many appear to be more characteristically woodlands. In addition, the alliance probably occurs in Alaska where a *Populus balsamifera* ssp. *trichocarpa* temporarily flooded woodland alliance has been identified, but is currently undescribed. The floristic relationships of these two alliances are unknown at present.

ALLIANCE SOURCES

Authors: D. CULVER, West **Identifier:** A.311

References: Blackburn et al. 1968a, Brown 1982, Crowe and Clausnitzer 1997, Daubenmire 1970, Eyre 1980, Franklin and Dyrness 1969, Franklin and Dyrness 1973, Hansen et al. 1991, Hansen et al. 1995, Hitchcock et al. 1964, Johnston 1987, Kartesz 1994a, Kauffman 1982, Kauffman et al. 1985, Kovalchik 1987, Manning and Padgett 1991, Manning and Padgett 1992, Moseley and Bursik 1994, Pfister et al. 1977, Poulton 1955, Reid et al. 1994, Sawyer and Keeler-Wolf 1995

POPULUS BALSAMIFERA SSP. TRICHOCARPA / CORNUS SERICEA FOREST Black Cottonwood / Red-osier Dogwood Forest

ELEMENT CONCEPT

Summary: This association has been documented from Washington south to northern California and eastward to Idaho and all of Montana west of the Continental Divide, as well as central Montana. In Montana alone it occurs over a broad elevation range of 610-2010 m (2000-6600 feet) where *Populus balsamifera* ssp. *trichocarpa* is the dominant cottonwood at elevations considered relatively low- to mid-gradient; in Idaho it ranges to 2135 m (7000 feet). This forest type occupies alluvial terraces of major rivers and streams, point bars, side bars, mid-channel bars, delta bars, an occasional lake or pond margin, and even creeps onto footslopes and lower subirrigated slopes of hilly or mountainous terrain. Many of these sites are flooded in the spring and dry deeply by summer's end; capillary action keeps upper portions of soil profile moist. Other sites are merely subirrigated. *Populus balsamifera* ssp. *trichocarpa* dominates the overstory with cover values ranging from approximately 12-90%, though the modal range, at least in Montana is 40-60%. *Populus angustifolia* is a subordinate canopy species in the eastern portion of the range, and *Populus tremuloides* and *Betula papyrifera* occur as subordinates in the western portion. The shrub layer comprises at least 25% cover with *Cornus sericea* diagnostic for the type and having anywhere from 1-90% cover; other shrub taxa with high constancy include *Symphoricarpos* spp., *Rosa* spp., *Salix* spp., *Crataegus* spp., *Amelanchier alnifolia*, and *Alnus incana*. There are no graminoids exhibiting high constancy, though any one of a number of disturbance-associated exotics can manifest high coverages. *Maianthemum stellatum*, *Galium triflorum*, *Solidago canadensis*, and *Equisetum* spp. are the only forbs that exhibit even relatively high constancy across the range of the type. This is a successional community that colonizes moist, newly deposited alluvium exposed to full sunlight; in the absence of fluvial disturbance it is capable of developing into conifer-dominated communities belonging to alliances as diverse as *Thuja plicata*, *Picea* spp. and *Juniperus scopulorum*. Adjacent wetter sites are dominated by a suite of wetland *Salix* spp., *Alnus incana*, wetland-associated *Carex* spp. often including *Carex utriculata*, *Carex aquatilis* and *Carex buxbaumii* or *Typha latifolia*-dominated communities. Adjacent drier sites are dominated by *Populus balsamifera* ssp. *trichocarpa* or *Populus tremuloides* types or any of a vast array of conifer-dominated types that are capable of growing within the elevational zone occupied by the *Populus balsamifera* ssp. *trichocarpa* / *Cornus sericea* Forest (CEGL000672).

Synonymy:

- *Populus trichocarpa*/*Cornus sericea* (Bourgeron and Engelking 1994) =
- DRISCOLL FORMATION CODE:I.B.3.d. (Driscoll et al. 1984) B
- *Populus trichocarpa* / *Cornus stolonifera* Forest (Evans 1989a) =. (p.17)
- *Populus trichocarpa* / *Cornus stolonifera* Forest (Kovalchik 1993) =. (p.86)

GRank & Reasons: G3? (00-05-01). Association rank has been changed from G3? to G3G4 on the basis of this type's broad geographic distribution and the fact that within local landscapes, say western Montana, it is relatively common. In Montana alone, this type is represented by 26 plots, and this is for the case of the most restrictive or conservative interpretation of criteria for the association. A thorough crosswalk of this type across its range of distribution is needed; there may be local variations in composition and ecology that would bear recognition of separate associations. Threats to this type include floodplain harvesting of cottonwood and over-browsing from livestock and wildlife, both entities of which find *Cornus sericea* extremely palatable to the point of extirpating it from local floodplain landscapes. The more serious over-browsing consequence is reduced diversity, the introduction of weedy species and the increase in unpalatable native taxa such as *Symphoricarpos occidentalis*, *Ribes* spp. and *Urtica dioica*.

Comments: There is considerable variability in defining this community at both the alliance (based on tree species composition) and association levels (based on undergrowth species). Some authors taking a habitat type approach have considered any stands with conifers represented (even in the seedling/sapling size classes) to be members of the alliance (series in habitat type idiom) of the most shade-tolerant conifer represented on site and not the alliance of the *Populus balsamifera* ssp. *trichocarpa*, or other deciduous trees dominant on the site. It is also a highly debatable point as to whether stands containing *Populus balsamifera* ssp. *trichocarpa* and *Populus tremuloides* should be allocated to the *Populus tremuloides* Forest Alliance (A.274) regardless of its cover value (as some authors have advocated) when in fact *Populus balsamifera* ssp. *trichocarpa* generally has a narrower ecological amplitude and better serves as a diagnostic species. Another troubling observation is that more than half of the identified stands have less than 60% tree canopy cover, which means that a significant portion of this association qualifies physiognomically as woodland, rather than as forest as currently classified. There are strongly discordant criteria as to how much *Cornus sericea* cover should be represented (ranging from 1-25%) for a stand to be considered a member of this association.

ELEMENT DISTRIBUTION

Range: This association has been documented from Washington south to northern California and eastward to Idaho and all of Montana west of the Continental Divide, as well as central Montana.

Nations: US

States/Provinces: CA:S1?, ID:S3, MT:S3?, OR:S2, WA:S2?

ELEMENT SOURCES

Authors: S.V. Cooper, WCS **Confidence:** 2 **Identifier:** CEGLO00672

References: Bourgeron and Engelking 1994, Driscoll et al. 1984, Evans 1989a, Hall and Hansen 1997, Hansen et al. 1991, Hansen et al. 1995, Kovalchik 1987, Kovalchik 1993

POPULUS BALSAMIFERA SSP. TRICHOCARPA / SYMPHORICARPOS ALBUS FOREST Black Cottonwood / Common Snowberry Forest

ELEMENT CONCEPT

Summary: This association is known from the Blue Mountains of eastern Oregon, through the Columbia Basin to the Cascades of eastern Washington, into central and northern Idaho, and north to the mountains of southern British Columbia. This late-seral association typically occurs at low elevations from 579 to 1128 m (1900-3700 feet) in broad mountain valleys and canyons of low- to moderate-gradient streams and rivers. The association occupies alluvial terraces with deep silty loam soils (over cobble and gravel) on infrequently flooded sites well above the average high water line and summer water table. Tall and mature *Populus balsamifera* ssp. *trichocarpa* form the open to closed overstory canopy, with occasional understory asexual reproduction and conifers present. Conifer species, especially *Pinus ponderosa* and *Pseudotsuga menziesii*, may indicate the potential successional pathway on these relatively dry terrace sites. The shrub layer is clearly dominated by *Symphoricarpos albus* (usually with at least 20% cover), although a variety of other tall and medium shrubs (all with cover less than *Symphoricarpos albus*) are usually present. The most consistently prominent shrubs are *Acer glabrum*, *Amelanchier alnifolia*, *Crataegus douglasii*, *Philadelphus lewisii*, *Prunus virginiana*, *Rosa* spp., and *Rubus parviflorus*, the presence of which may reflect successional relationships with other alluvial terrace associations. The herbaceous layer is diverse, but has only moderate cover, and often includes exotic species indicative of past disturbance. Perennial grasses, especially *Elymus glaucus*, *Phalaris arundinacea*, and *Poa pratensis*, often codominate with various tall forbs and *Equisetum* spp. The most important forbs include *Clematis ligusticifolia*, *Heracleum maximum*, *Maianthemum* spp., *Thalictrum occidentale*, and *Urtica dioica*.

Environment: This association is a mid- to late-seral association that usually occurs on inactive floodplain terraces that flood only episodically. Over time, these terraces may wash away from lateral movement of the channel (Moseley and Bursik 1994, Hansen et al. 1995). In addition, *Populus balsamifera* ssp. *trichocarpa* reproduction is low and limited to less vigorous asexual suckering. Without intact ecological processes promoting stand replacement and succession, long-term persistence of this type will decrease. Young stands of *Populus balsamifera* ssp. *trichocarpa* establish on fresh alluvium found on point bars and banks of rivers with intact, natural flooding regimes (Moseley and Bursik 1994, Hansen et al. 1995, Crowe and

Clausnitzer 1997, Crawford 2001, Jankovsky-Jones 2001, Kovalchik 2001). As rivers downcut and channels migrate over time, these point bars and banks are less frequently flooded and loamy soils develop. These sites are favorable for *Symphoricarpos albus* establishment and formation of new stands of this association.

Vegetation:

Dynamics: This association usually occurs on inactive floodplains, which flood only episodically. This may result in eventual succession to a conifer type, although the terrace may get washed away from lateral movement of the channel before this happens (Moseley and Bursik 1994). In general, *Populus balsamifera ssp. trichocarpa* reproduction is low and limited to less vigorous asexual suckering. Without new stands being formed on younger terraces, long-term declines in stand area will occur. In addition, continuous and severe grazing results in a decline of *Symphoricarpos albus*, while *Poa pratensis* increases in abundance. Wildfire may maintain this type, as has been documented from a 1931 fire in northern Idaho (Moseley and Bursik 1994) and a 1986 fire in west-central Idaho (Jankovsky-Jones et al. 2001). However, if site conditions become too dry or grazing is too heavy for resprouting species to persist, stand area will decline (Crowe and Clausnitzer 1997, Kovalchik 2001).

GRank & Reasons: G2 (02-10-22). This association is a relatively wide-ranging and broadly defined association occurring on infrequently flooded alluvial terraces of low-elevation streams and rivers of the inland Pacific Northwest. It is usually distinct from related *Populus balsamifera ssp. trichocarpa* stands with tall-shrub understories. This type is not as immediately affected by flow alteration as some other *Populus balsamifera ssp. trichocarpa* types, but the quality and viability of most occurrences are decreased due to many anthropogenic disturbances, including flow regime changes. These disturbances include clearing for road building and urbanization; recreation impacts; dams, flood control levees, and diversions reducing flood peaks and deposition necessary for *Populus balsamifera ssp. trichocarpa* reproduction; and cattle grazing (decreasing *Populus balsamifera ssp. trichocarpa* and *Symphoricarpos albus* reproduction while promoting exotic species). Interruption of the natural flooding regime on many low-elevation rivers with potential to support this association have occurred resulting in long-term declines from lack of stand replacement. Although there are about 40 to 50 known occurrences, most stands cover relatively small areas and are in poor to fair ecological condition. For these reasons, changing the original rank from G2? to G2 is justified.

Comments: This association has been quantitatively described by seven different studies with at least 48 plots (Kovalchik 1987, Crowe and Clausnitzer 1997, Moseley and Bursik 1994, Crawford 2001, Jankovsky-Jones et al. 2001, Kovalchik 2001, Crowe et al. 2002). This association belongs to a complex of ecologically related associations with similar species composition, including *Populus balsamifera ssp. trichocarpa* / *Alnus incana* Forest (CEGL000667), *Populus balsamifera ssp. trichocarpa* / *Crataegus douglasii* Forest (CEGL000673), and others not yet incorporated into the National Vegetation Classification: *Populus balsamifera ssp. trichocarpa* / *Acer glabrum*, and *Populus balsamifera ssp. trichocarpa* / *Philadelphus lewisii* (Crowe and Clausnitzer 1987, Crawford 2001, Holmstead 2001, Jankovsky-Jones et al. 2001, Crowe et al. 2002). The understory dominance by *Symphoricarpos albus*, with higher cover and constancy than tall shrubs, separates this association from those where *Acer glabrum*, *Alnus incana*, *Crataegus douglasii*, or *Philadelphus lewisii* have equal or greater cover and constancy.

ELEMENT DISTRIBUTION

Range: This association is known from low-elevation, large rivers in Oregon, Washington, Idaho, and British Columbia. It is expected to occur in Montana, but has not been documented.

Nations: CA? US

States/Provinces: BC?, ID:S2, OR:S2, WA:S1S2

ELEMENT SOURCES

Authors: C. Murphy, WCS **Confidence:** 1 **Identifier:** CEGL000677

References: Bourgeron and Engelking 1994, Crawford 2001, Crowe and Clausnitzer 1997, Crowe et al. 2002, Driscoll et al. 1984, Evans 1989a, Hansen and Hall 2002, Hansen et al. 1995, Holmstead 2001, IDCDC 2002, Jankovsky-Jones et al. 2001, Kauffman et al. 1985, Kovalchik 1987, Kovalchik 2001, Moseley and Bursik 1994, Sunderman 2000, WANHP 2002, Walford et al. 2001

II. WOODLAND

PICEA ENGELMANNII SEASONALLY FLOODED WOODLAND ALLIANCEEngelmann Spruce Seasonally Flooded Woodland Alliance

ALLIANCE CONCEPT

Environment: These are montane woodlands found on riparian and wetland landforms in the Oregon and Washington Cascades, and other mountains of eastern Washington. Elevations range from 1280 m to 2200 m. Sites include the relatively dry edges of mountain meadows, stream terraces, lake basins, or wetter sites on the margins of bogs, marshes, floodplains or

headwaters basins. It can also be found as narrow stringers along the banks of steep subalpine streams. Valleys where the alliance occurs can be broad U-or trough-shaped or narrow and V-shaped. Most sites are flat or gently sloped, with alluvial soils. These woodlands experience seasonal flooding, and in some cases the water table may be high year-round. In the Cascades, parent materials include granitic alluvium, or air-laid pumice, pumice alluvium or pumice lacustrine deposits. They can be deep, or have an impermeable or compacted mineral soil below. There is often an organic layer of organic loam, sedge peat or moss peat, except in riparian sites, where cobbles and gravels make up a large component of the soils. Some stands may fit the definition of wooded bogs.

Vegetation: These are riparian and wetland woodlands, dominated by conifers, with tree canopy cover ranging from 30-70%. *Picea engelmannii* is always present in the canopy and usually is dominant. *Pinus contorta* is often present and can be codominant, while *Abies lasiocarpa* is only occasional and is not abundant. A low-shrub layer is often present, dominated by *Vaccinium uliginosum*, *Vaccinium caespitosum*, and *Spiraea douglasii*, with *Salix geyeriana*, *Salix boothii*, *Salix eastwoodiae*, *Salix lemmonii*, *Lonicera caerulea*, *Vaccinium membranaceum*, *Linnaea borealis*, or *Ledum glandulosum* occasionally present. The herbaceous layer is dominated by perennial sedges or forbs, and has cover ranging from 25% to over 70%. The most common or abundant graminoids include *Carex scopulorum*, *Carex scopulorum* var. *prionophylla*, *Carex aquatilis*, *Carex jonesii*, *Eleocharis quinqueflora*, *Calamagrostis canadensis*, *Equisetum arvense*, and *Deschampsia caespitosa*. Important forbs include *Pedicularis groenlandica*, *Trifolium longipes*, *Clintonia uniflora*, *Streptopus amplexifolius*, *Saxifraga oregana*, and *Dodecatheon* spp. Mosses are abundant and in some stands form peaty mats; *Sphagnum* spp. are the most important.

Dynamics: As with most riparian habitats, the majority of these woodlands are successional, dependent on periodic flooding events as well as fire for maintenance.

Comments: The complex of riparian and wetland forests and woodlands dominated by *Picea engelmannii* needs extensive review to clarify floristic and ecological similarities and differences. This includes the *Picea engelmannii* Seasonally Flooded Forest Alliance (A.191), *Picea engelmannii* Seasonally Flooded Woodland Alliance (A.572), *Picea engelmannii* Temporarily Flooded Woodland Alliance (A.566), and *Picea engelmannii* Temporarily Flooded Forest Alliance (A.179). Only the *Picea engelmannii* Seasonally Flooded Woodland Alliance has been described; the other three will be completed following review of the classification of the individual associations.

ALLIANCE SOURCES

Authors: M.S. REID, West **Identifier:** A.572

References: Chappell et al. 1997, Kovalchik 1987, Kovalchik 1993, Seyer 1979

PICEA ENGELMANNII / CAREX SCOPULORUM VAR. PRIONOPHYLLA WOODLAND Engelmann Spruce / Holm's Rocky Mountain Sedge Woodland

ELEMENT CONCEPT

Summary: This association occurs at mid-montane to subalpine elevations between 4200-7200 feet in the northeastern Cascade and Selkirk mountains of Washington. It likely is found in adjacent British Columbia, Idaho and perhaps Montana. This association is an open to closed wetland forest (around 60% cover of trees) that always has *Picea engelmannii* as the dominant tree. *Picea engelmannii* is often accompanied by *Abies lasiocarpa* or *Pinus contorta* var. *latifolia*. *Carex scopulorum* (var. *prionophylla* or var. *bracteosa*) is always present, typically with over 25%. *Calamagrostis canadensis* is a frequent, sometimes abundant, associated grass. Forbs and shrubs are found on sites but rarely abundantly. Shrubs, such as *Ledum glandulosum* or *Vaccinium scoparium*, are found on hummocks. This is found in wetland or riparian mosaics with *Salix farriarum* / *Carex scopulorum* or *Carex scopulorum* marshes.

GRank & Reasons: G3 (00-12-11). This is a regional endemic wetland forest community. The association is abundant at subalpine to mid-montane elevations in the northeastern Cascade and Selkirk mountains of Washington and is likely in adjacent British Columbia and Idaho. It is restricted to margins of large flat wetland basins and to narrow stringers along banks of steep permanent subalpine streams. Although its hydrology and elevation range provide some protection, its regional endemism and wetland status give a moderate rare status. The number of occurrences is estimated from a single draft riparian classification survey. It is vulnerable to logging and stand-replacing fires that alter hydrologic regimes as well as stand structure.

Comments: Montana's *Abies lasiocarpa* / *Ledum glandulosum* association (Hansen et al. 1995) lists *Carex scopulorum* with high average cover in 2 of 8 stands but is likely different since *Picea* species are mostly *Picea engelmannii* X *glauca* hybrids.

ELEMENT DISTRIBUTION

Range: This association occurs at mid-montane to subalpine elevations (4200-7200 feet) in the northeastern Cascade and Selkirk mountains of Washington and British Columbia. Probably some in Idaho. It may be in Montana where it may be called *Abies lasiocarpa* / *Ledum glandulosum* although *Picea* species are often *Picea engelmannii* X *glauca*.

Nations: CA US

States/Provinces: BC?, ID:S4, WA:S2S3

ELEMENT SOURCES

Authors: R.C. Crawford, WCS **Confidence:** 1 **Identifier:** CEG002630

References: Bourgeron and Engelking 1994, Driscoll et al. 1984, Hansen et al. 1995, Kovalchik 1993, WANHP n.d.

III. SHRUBLAND

ALNUS INCANA TEMPORARILY FLOODED SHRUBLAND ALLIANCE Speckled Alder Temporarily Flooded Shrubland Alliance

ALLIANCE CONCEPT

Summary: Vegetation types within this riparian shrubland alliance typically occur adjacent to streams and in mountain meadows. Landforms associated with this alliance are streambanks, alluvial bars, and floodplains. Sites are young, active channel shelves that lie between active and flood-stage streambanks along second-order and larger streams in moderately graded (3-5%) valleys. Elevations range from near sea level in Alaska to 3000 m in Colorado. Soils are shallow, skeletal alluvium over water-worked cobbles and gravels. Active channel shelves have surface soil textures that are loamy sands, while older sites are silts and loam. Available water-holding capacity is low; surface water is present briefly during the growing season. The water table usually lies well below the ground surface. *Alnus incana* forms a dense canopy with at least 90% cover. The diverse understory shrub layer may include *Cornus sericea*, *Betula occidentalis*, *Ribes hudsonianum*, *Symphoricarpos albus*, *Salix drummondiana*, and *Oplopanax horridus*. The forb layer is sparse and may include *Canadanthus modestus* (= *Aster modestus*), *Symphyotrichum spathulatum* (= *Aster occidentalis*), *Galium triflorum*, *Senecio triangularis*, and *Thalictrum occidentale*. The graminoid layer is usually dominated by 1 or 2 species that include *Agrostis stolonifera* and *Calamagrostis canadensis*. The fern and fern allies layer is generally dense with at least 40% cover. The dominant species typically are *Gymnocarpium dryopteris* and *Athyrium filix-femina*.

Environment: Vegetation types within this alliance typically occur adjacent to streams and in mountain meadows. Landforms associated with this alliance are streambanks, alluvial bars, and floodplains. Sites are young, active channel shelves that lie between active and flood-stage streambanks along second-order and larger streams in moderately graded (3-5 percent) valleys. Elevations range from near sea level in Alaska to 3000 m in Colorado.

Soils are shallow, skeletal alluvium over water-worked cobbles and gravels. Active channel shelves have surface soil textures that are loamy sands while older sites are silts and loam. Available water-holding capacity is low, surface water is present briefly during the growing season. The water table usually lies well below the ground surface.

Coniferous and cottonwood forests typically grow on adjacent upslopes.

Vegetation: Vegetation types within this alliance are classified as temporarily flooded, cold-deciduous shrublands. *Alnus incana* forms a dense canopy with at least 90% cover. The diverse understory shrub layer may include *Cornus sericea*, *Betula occidentalis*, *Ribes hudsonianum*, *Symphoricarpos albus*, *Salix drummondiana*, and *Oplopanax horridus*. The forb layer is sparse and may include *Canadanthus modestus* (= *Aster modestus*), *Symphyotrichum spathulatum* (= *Aster occidentalis*), *Galium triflorum*, *Senecio triangularis*, and *Thalictrum occidentale*. The graminoid layer is usually dominated by 1 or 2 species that include *Agrostis stolonifera* and *Calamagrostis canadensis*. The fern and fern allies layer is generally dense with at least 40% cover. The dominant species typically are *Gymnocarpium dryopteris* and *Athyrium filix-femina*.

Dynamics: *Alnus incana* is a long-lived, early-seral species. It is one of the first species to establish on fluvial or glacial deposits as well as the spoils of placer mining (Hansen et al. 1989). After establishment, young stands of *Alnus incana* are continually flooded. As stands mature, the stems can slow flood waters and trap sediment. Fine-textured sediments accumulate on top of the coarser alluvial material, and the land surface eventually rises above annual flood levels. Flooding is then less frequent and soils begin to develop (Padgett et al. 1989).

Alnus incana is shade-intolerant (Viereck 1970, Chapin et al. 1994 as cited in Kittel et al. 1999), and many mature stands are restricted to streambank edges, possibly because these are the only sites where light can penetrate the neighboring overstory canopy. *Alnus incana* has been observed on high-gradient streams and is thought to require well-aerated water (Hansen et al. 1988b, Padgett et al. 1989).

Undisturbed *Alnus incana* stands may become dominated by *Salix* species or conifer stands (Hansen et al. 1989). In Alaska, thick stands of alders inhibit succession by competing with spruce for nutrients and light (Chapin et al. 1994 as cited in Kittel et al. 1999). In Utah, *Acer negundo* often becomes the dominant canopy species on more xeric sites (Padgett et al. 1989).

Alnus incana fixes atmospheric nitrogen through a symbiotic relationship with the bacteria *Frankia* and increases the ecosystem nitrogen supply with the deposition of nitrogen-rich leaf litter (Binkley 1986 as cited in Kittel et al. 1999). The annual input of nitrogen to soils from alder species ranges from 16 to 150 kg/ha annually compared to 1 to 10 kg/ha/yr deposited by atmospheric precipitation alone (Binkley 1986 as cited in Kittel et al. 1999). Nitrogen-rich detritus is an important source of nutrients for the aquatic ecosystem as well.

ALLIANCE SOURCES

Authors: D. CULVER, West **Identifier:** A.950

References: Cooper and Cottrell 1990, Crowe and Clausnitzer 1997, Evans 1989a, Evenden 1990, Hansen 1942, Hansen et al. 1988b, Hansen et al. 1989, Hansen et al. 1990, Hansen et al. 1991, Hansen et al. 1995, Hickman 1993, Johnson 1968, Johnston 1987, Kauffman 1982, Kauffman et al. 1985, Kettler and McMullen 1996, Kittel and Lederer 1993, Kittel et al. 1994, Kittel et al. 1995, Kittel et al. 1996, Kittel et al. 1999a, Kovalchik 1987, Kovalchik 1993, Manning 1988, Manning and Padgett 1989, Miller 1976, Padgett 1982, Padgett et al. 1988b, Padgett et al. 1989, Richard et al. 1996, Sawyer and Keeler-Wolf 1995, Tuhy and Jensen 1982, Youngblood et al. 1985a

ALNUS INCANA / MESIC GRAMINOIDS SHRUBLAND Speckled Alder / Mesic Graminoids Shrubland

ELEMENT CONCEPT

Summary: This shrubland association is a widespread community of limited extent in the western states of Idaho, Colorado, Utah, Wyoming, and Nevada. Stands occur in narrow to moderately wide floodplains on stream benches, in association with abandoned meanders, on islands and pointbars, and on hillside seeps. These shrublands are characterized by stands of medium-tall and tall, deciduous shrubs and a thick herbaceous undergrowth of wetland-indicator grasses, and little to no overstory tree canopy. Total shrub cover is usually over 50% and is dominated by *Alnus incana*, the diagnostic shrub. Other shrubs include *Salix* spp., *Betula occidentalis*, and *Cornus sericea*. The understory of undisturbed stands has a dense herbaceous cover including *Glyceria* spp., *Calamagrostis canadensis*, *Elymus glaucus*, *Carex* spp., and *Equisetum* spp. Heavily disturbed stands have abundant non-native grasses. In Nevada, Utah, southeastern Idaho, and Wyoming, this type is considered a grazing-induced community derived from *Alnus incana* / Mesic Forbs Shrubland (CEGL001147). However, several stands in Colorado are undisturbed and the undergrowth is dominated by native graminoid cover.

Environment: Stands occur in narrow to moderately wide floodplains on stream benches, in association with abandoned meanders, on islands and pointbars, and on hillside seeps. *Alnus incana* tends to dominate narrow streambanks where stream gradients are relatively steep, or on more cobbly substrates than their willow neighbors in broad floodplain settings. Stream channels can be steep and straight to highly sinuous (Rosgen's Channel Type: A3, A4, F3) or moderately steep and sinuous (Rosgen's Channel Type: B2, B3, B4, B6) (Rosgen 1996). Where this association occurs on point bars, stream channels are low gradient (<1% gradient) and highly sinuous (Rosgen's Channel Type: C5) (Rosgen 1996). Soils are mostly coarse alluvium, but characteristically have silt loams or sandy clay loams at the surface with a high percentage of organic matter. Soils are shallow to moderately deep, 15-30 inches (35-62 cm), and become increasingly skeletal with depth. Most profiles have 10-50% mottles at 7-10 inches (18-25 cm) depth. One profile had gleyed, mineral soils indicating saturated conditions.

Vegetation: These shrublands are characterized by stands of medium-tall and tall, deciduous shrubs and a thick herbaceous undergrowth of wetland-indicator grasses, and little to no overstory tree canopy. Total shrub cover is usually over 50% and is dominated by *Alnus incana*, the diagnostic shrub. *Alnus incana* ssp. *tenuifolia* dominates the upper canopy with 10-90% cover. Other shrubs occasionally present include *Salix exigua*, *Salix monticola*, *Rubus deliciosus*, *Salix bebbiana*, *Salix drummondiana*, *Rosa woodsii*, and *Cornus sericea*. Occasionally, trees may be scattered throughout the shrubland, or occur along one edge. Tree species include *Populus deltoides* ssp. *monilifera* and *Salix fragilis*.

The undergrowth is a thick carpet of grasses. Native graminoids include *Calamagrostis canadensis*, *Carex utriculata*, *Glyceria striata*, *Carex aquatilis*, *Carex pellita* (= *Carex lanuginosa*), and *Festuca rubra*. Heavily disturbed stands are dominated by introduced, non-native grasses including *Poa pratensis*, *Agrostis stolonifera*, and *Bromus inermis*. Forb cover is usually low relative to the amount of graminoid cover, but can include a high variety of species, including *Mertensia ciliata*, *Mentha arvensis*, *Cardamine cordifolia*, and *Caltha leptosepala*.

Dynamics: *Alnus incana* ssp. *tenuifolia* is a long-lived, early-seral species. It is one of the first species to establish on fluvial or glacial deposits as well as the spoils of placer mining (Viereck 1970, Van Cleve et al. 1971, Chapin et al. 1994, Hansen et al. 1989). After establishment, young stands of *Alnus incana* are continually flooded. As stands mature, the stems can slow flood waters and trap sediment. Fine-textured sediments accumulate on top of the coarser alluvial material and the land surface eventually rises above annual flood levels. Flooding is then less frequent and soils begin to develop (Padgett et al. 1989).

Alnus incana is shade-intolerant (Viereck 1970, Chapin et al. 1994), and many mature stands in Colorado are restricted to streambank edges, possibly because these are the only sites where light can penetrate the neighboring overstory canopy. *Alnus incana* has been observed on high-gradient streams and is thought to require well-aerated water (Hansen et al. 1988b, Padgett et al. 1989).

Undisturbed *Alnus incana* stands may become dominated by *Salix* (willow) species or conifer stands (Hansen et al. 1989). In Alaska, thick stands of alders inhibit succession by competing with spruce for nutrients and light (Chapin et al. 1994). In Utah, *Acer negundo* (box-elder) often becomes the dominant canopy species on more xeric sites (Padgett et al. 1989).

Alnus incana fixes atmospheric nitrogen through a symbiotic relationship with the bacteria *Frankenia* and increases the ecosystem nitrogen supply with the deposition of nitrogen-rich leaf litter (Binkley 1986). The annual input of nitrogen to

soils from alder species ranges from 10 to 150 times the amount deposited by atmospheric precipitation alone (Binkley 1986, Bowman and Steltzer in press). Nitrogen rich detritus is an important source of nutrients for the aquatic ecosystem as well.

In Nevada, Utah, southeastern Idaho, Montana, and Wyoming, the *Alnus incana* / mesic graminoid type is considered a grazing-induced community, derived from the *Alnus incana* / mesic forb plant association (Padgett et al. 1989, Manning and Padgett 1995, Jones 1992c). In Colorado, most stands of this plant association appear to be disturbed by improper grazing and have an abundance of non-native graminoid species. A few stands, however, appear undisturbed and have an undergrowth dominated by native grasses.

GRank & Reasons: G3 (00-10-16). This association has a wide range, but stands of this shrubland association are restricted to small patches less than 10 acres in size. High-quality examples of this association without non-native species are very rare. Threats are numerous as most stands are within watersheds with a continuing history of livestock grazing, logging, recreational activities, hydrologic modifications, and road building. Stands are used as loafing grounds by livestock because of the presence of shade, and cover of shrubs may be reduced due to trampling. Heavy grazing will reduce the cover of herbaceous species and compact soils, which may increase soil erosion. Other activities in the watershed such as road and railroad construction and maintenance, logging, and heavy recreational use may contribute weeds and sediments that alter species composition in stands. Stands are also threatened by impacts to hydrology from streamflow modification.

Comments: Classification is based on data collected from throughout the range of the association. Some classifications have considered this a grazing-induced sere of the *Alnus incana* / Mesic Forbs Shrubland (CEGL001147) (Padgett et al. 1989, Manning and Padgett 1995). High-quality stands with a native understory are uncommon, but are reported in Colorado and Idaho, and are suspected in Wyoming. In Oregon, five *Alnus incana* plant associations (*Alnus incana* / *Glyceria elata*, *Alnus incana* / *Calamagrostis canadensis*, *Alnus incana* / *Scirpus microcarpus*, *Alnus incana* / *Carex amplifolia*, and *Alnus incana* / *Carex pellita*) were described and one or more may belong in this association.

ELEMENT DISTRIBUTION

Range: This plant association is a minor riparian type in Idaho, Colorado, Utah, Wyoming, and Nevada.

Nations: US

States/Provinces: CO:S3, ID:S?, NV:S?, UT:S2S3, WY:S?Q

ELEMENT SOURCES

Authors: M. Jankovsky-Jones, mod. G. Kittel, WCS **Confidence:** 2 **Identifier:** CEGL001148

References: Binkley 1986, Bourgeron and Engelking 1994, Bowman and Steltzer n.d., Chapin et al. 1994, Driscoll et al. 1984, Hansen et al. 1988b, Hansen et al. 1989, Jones 1992b, Kettler and McMullen 1996, Kittel et al. 1996, Kittel et al. 1999a, Manning and Padgett 1995, Padgett et al. 1989, Richard et al. 1996, Rosgen 1996, Van Cleve et al. 1971, Viereck 1970

SALIX (EXIGUA, INTERIOR) TEMPORARILY FLOODED SHRUBLAND ALLIANCE (Coyote Willow, Sandbar Willow) Temporarily Flooded Shrubland Alliance

ALLIANCE CONCEPT

Summary: Plant associations within this temporarily flooded shrubland alliance are located on floodplains and gravel bars between 780-1760 m in the western U.S., and at lower elevations (to below 100 m) in the midwestern and southeastern U.S. Stands may be dominated either by *Salix exigua* (in the West) or *Salix interior* (in the Midwest and East). Both species or intermediates may occur in stands in the region where the range of the two species overlap. These shrublands are found on open sandbars without canopy shading on larger, well-developed drainages and along larger sandy rivers, or on coarser-textured substrates. They are associated with annual flooding and inundation and will grow well into the channel, where it is flooded, even in drier years. Even though flooding is frequent, surface water is not present for much of the growing season, and the water table is well below the surface. Some stands form large, wide stands on mid-channel islands on larger rivers, or narrow stringer bands on small, rocky tributaries. Stream reaches range widely from moderately sinuous and moderate-gradient reaches to broad, meandering rivers with wide floodplains or broad, braided channels. Many stands also occur within highly entrenched or eroding gullies. Soils of this alliance are typically coarse alluvial deposits of sand, silt and cobbles that are highly stratified with depth from flooding scour and deposition. The stratified profiles consist of alternating layers of clay loam and organic material with coarser sand or thin layers of sandy loam over very coarse alluvium. Occasionally, stands may occur on deep pockets of sand. The pH of the substrate ranges from 6.0-6.8. The canopy is dominated by a tall, 2- to 5-m, broad-leaved deciduous shrub that is typically many-branched with continuous cover of 60-100%. The herbaceous stratum has sparse to moderate cover including a variety of pioneering species. Plant associations within this alliance are characterized as temporarily flooded, cold-deciduous shrubland dominated by *Salix exigua* or *Salix interior*. The tall-shrub layer has 15-90% cover, ranging in height between 2-5 m. Other willows can occur in the canopy including *Salix eriocephala*, *Salix lutea*, *Salix ligulifolia*, and/or *Salix monticola*. Occasionally taller *Salix amygdaloides* or *Populus deltoides* occur within the tree subcanopy. The herbaceous layer varies greatly over the broad range of the alliance. It typically has at least 20-35% cover of various graminoid species including *Carex nebrascensis*, *Carex pellita* (= *Carex lanuginosa*), *Spartina*

pectinata, *Phalaris arundinacea*, *Equisetum arvense*, *Panicum bulbosum*, and *Muhlenbergia rigens*. The forb cover is usually sparse. The understory can be dominated by barren ground or gravel bar. This alliance represents an early seral, primary successional stage on newly deposited sediments that may persist under a regime of repeated fluvial disturbance. *Salix exigua* and *Salix interior* are highly adapted to most forms of disturbance. Both species are prolific sprouters and will reestablish themselves on sites dominated by other disturbance-associated species, e.g., *Glycyrrhiza lepidota* and *Pascopyrum smithii* (= *Agropyron smithii*). Associations in this shrubland alliance are common and widespread.

Shrublands dominated solely by *Salix exigua* (*sensu stricto*) extend from the Pacific Northwest and California east into the Rocky Mountains and onto the Great Plains. Stands of possibly mixed or ambiguous composition may occur from the northern Great Plains south to the Colorado plains, possibly extending into northeastern New Mexico and the western portions of the Dakotas, Nebraska, Kansas, and Oklahoma. Examples dominated by *Salix interior* occur in the Midwest in Iowa, Illinois, Indiana, Ohio, and the eastern portions of North Dakota, South Dakota, Nebraska, and Kansas. They also extend into Arkansas, Tennessee, Kentucky, Texas, and eastern Oklahoma, and possibly in Pennsylvania and West Virginia, as well as in Manitoba and other provinces of Canada. In western Oklahoma and throughout the Ozarks the associations are local along major streams. In the West, adjacent upland plains communities include agricultural fields and rolling hills of *Artemisia filifolia*, xeric tallgrass prairies, and *Bouteloua gracilis* shortgrass prairies. In the steep canyons of the foothills, upslope vegetation includes *Pseudotsuga menziesii* and *Pinus ponderosa* forests, *Pinus edulis* and *Juniperus* spp. woodlands, oak, sagebrush, and greasewood scrub. In the lower montane, upslope vegetation includes *Pinus contorta* and *Populus tremuloides* forests.

Environment: Plant associations within this alliance are located on floodplains and gravel bars at an elevational range between 780 and 1760 m in the West, and at lower elevations (to below 100 m) in the midwestern and southeastern United States. These shrublands are found on open sandbars without canopy shading on larger, well-developed drainages and along larger sandy rivers, or on coarser-textured substrates. They are associated with annual flooding and inundation and will grow well into the channel, where it is flooded, even in drier years. Even though flooding is frequent, surface water is not present for much of the growing season and the water table is well below the surface. Some stands form large, wide stands on mid-channel islands on larger rivers, or narrow stringer bands on small, rocky tributaries. Stream reaches range widely from moderately sinuous and moderate-gradient reaches to broad, meandering rivers with wide floodplains or broad, braided channels. Many stands also occur within highly entrenched or eroding gullies.

Soils of this alliance are typically coarse alluvial deposits of sand, silt and cobbles that are highly stratified with depth from flooding scour and deposition. The stratified profiles consist of alternating layers of clay loam and organic material with coarser sand or thin layers of sandy loam over very coarse alluvium. Occasionally, stands may occur on deep pockets of sand. The pH of the substrate ranges from 6.0-6.8 (Johnson 1987).

In the West, adjacent upland plains communities include agricultural fields and rolling hills of *Artemisia filifolia*, xeric tall-grass prairies and *Bouteloua gracilis* shortgrass prairies. In the steep canyons of the foothills, upslope vegetation includes *Pseudotsuga menziesii* and *Pinus ponderosa* forests, *Pinus edulis* and *Juniperus* spp. woodlands, oak, sagebrush, and greasewood scrub. In the lower montane, upslope vegetation includes *Pinus contorta* and *Populus tremuloides* forests.

Vegetation: Plant associations within this alliance are characterized as temporarily flooded cold-deciduous shrubland dominated by *Salix exigua* or *Salix interior*. The tall-shrub layer has 15-90% cover, ranging in height between 2-5 m. Other willows can occur in the canopy including *Salix eriocephala*, *Salix lutea*, *Salix ligulifolia* and *Salix monticola*. Occasionally the taller *Salix amygdaloides* or *Populus deltoides* occur within the tree subcanopy. The herbaceous layer varies greatly over the broad range of the alliance. It has at least 20-35% cover of various graminoid species including *Carex nebrascensis*, *Carex pellita* (= *Carex lanuginosa*), *Spartina pectinata*, *Phalaris arundinacea*, *Equisetum arvense*, *Panicum bulbosum*, and *Muhlenbergia rigens*. The forb cover is usually sparse. The understory can be dominated by barren ground or gravel bar. In Oklahoma, some associates can include *Cephalanthus occidentalis*, *Eupatorium serotinum*, *Panicum virgatum*, *Parthenocissus quinquefolia*, *Pluchea odorata*, *Tamarix chinensis*, and *Vitis acerifolia* (Hoagland 2000).

Dynamics: This alliance represents an early seral primary successional stage on newly deposited sediments that may persist under a regime of repeated fluvial disturbance. *Salix exigua* and *Salix interior* are highly adapted to most forms of disturbance. Both species are prolific sprouters and will reestablish themselves on sites dominated by other disturbance associated species, e.g., *Glycyrrhiza lepidota* and *Pascopyrum smithii*.

Comments: In the West, *Salix exigua* alliances differ due to the structure of the vegetation and hydrologic regimes. The woodland alliances contain open stands of trees with crowns not touching (generally forming 25-60% cover). The hydrologic regimes differ due to the length of time that the surface water is present and depth to the water table. The surface water in the seasonally flooded alliance is present for extended periods during the growing season, and the water table is typically near the surface. It occurs in interdune depressions. On the other hand, the surface water in the temporarily flooded alliance is only present for brief periods during the growing season, and the water table is well below the surface. Its habitat is strictly riverine. In contrast, *Salix interior* does not develop stands which would be considered to have a woodland physiognomy, and all examples are considered to be temporarily flooded (e.g., riverine).

ALLIANCE SOURCES

Authors: GREAT PLAINS PROGRAM 1-95, JT, West **Identifier:** A.947

References: Brown 1982, Brown et al. 1979, Christy 1973, Cooper and Cottrell 1990, Dick-Peddie et al. 1984, Dorn 1997, Evenden 1990, Faber-Langendoen et al. 1996, Foti et al. 1994, Hansen et al. 1989, Hansen et al. 1991, Hansen et al. 1995, Hoagland 1998c, Hoagland 2000, Johnston 1987, Jones and Walford 1995, Kagan 1997, Kittel 1994, Kittel and Lederer 1993, Kittel et al. 1994, Kittel et al. 1995, Kittel et al. 1996, Kittel et al. 1999a, Kovalchik 1987, Muldavin et al. 1993a, Muldavin et al. 1994a, Muldavin et al. 2000a, Myhre and Clements 1972, Padgett et al. 1988b, Padgett et al. 1989, Phillips 1977, Sawyer and Keeler-Wolf 1995, Shelford 1954, Tuhy and Jensen 1982, Youngblood et al. 1985a

SALIX EXIGUA TEMPORARILY FLOODED SHRUBLAND Coyote Willow Temporarily Flooded Shrubland
Sandbar Willow Shrubland

Ecological Group (SCS;MCS): Northern and Central Great Plains Wooded Riparian Vegetation (560-05; 1.6.5.1)

ELEMENT CONCEPT

Summary: This willow shrubland community is found throughout the northwestern United States and Great Plains. This type is an early successional stage that occurs along rivers and streams at lower elevations, on recently flooded riparian areas, and in moist swales and ditches that are frequently disturbed. Stands occur most commonly on alluvial sand, but silt, clay, or gravel may also be present. *Salix exigua* is the dominant canopy species (*Salix interior* or intermediates of the two willow species may be present in the eastern part of the range). It can form dense stands up to 4 m tall, but there are often patches where the shrub layer is absent. Seedlings and small saplings of *Populus deltoides* and *Salix amygdaloides* may be present. The herbaceous cover is sparse to moderate, but rarely exceeds 30%. Species present include *Cenchrus longispinus*, *Polygonum lapathifolium*, *Schoenoplectus americanus* (= *Scirpus americanus*), *Triglochin maritima*, and *Xanthium strumarium*. The composition of this community, especially the herbaceous layer, varies from year to year with succession or renewed disturbance.

Environment: This community is found on recently deposited or disturbed alluvial material. The parent material is alluvial sand, although silt, clay, or gravel may be present. Soil development is poor to absent.

Vegetation: This community is dominated by shrubs, generally between 2 and 4 m tall. The most common of these is *Salix exigua* (*Salix interior* or intermediates of the two willow species may be present in the eastern part of the range). *Salix irrorata* and saplings of *Populus deltoides* or *Salix amygdaloides* are also frequently found in the shrub layer in lower elevation stands. This stratum can have moderate to high stem density in the community as a whole. The species in the shrub layer do not form a closed canopy, allowing significant light to reach the ground layer. There are often patches where the shrub layer is absent. The herbaceous cover is sparse to moderate, but rarely exceeds 30%. Older stands and places with less competition from the shrubs have greater herbaceous cover. The composition of the herbaceous layer can vary greatly. Species that are often found in this community are *Cenchrus longispinus*, *Polygonum lapathifolium*, *Schoenoplectus americanus* (= *Scirpus americanus*), *Triglochin maritima*, *Xanthium strumarium*, *Juncus balticus*, *Eleocharis palustris*, *Elymus repens* (= *Elytrigia repens*), *Poa pratensis*, *Phleum pratense*, *Agrostis scabra*, *Bromus inermis*, *Heracleum maximum*, *Achillea millefolium*, *Solidago* sp., *Equisetum arvense*, and *Linaria vulgaris*.

Dynamics: This type originates after flash floods that create new deposits or scour existing alluvial material. This community is a primary or early secondary community and requires floods to create new areas on which it can develop. Once established, without further flooding disturbance and sediment deposition, this community may not exist for more than 10-20 years before it is replaced by a later seral stage.

Similar Associations:

- *Salix exigua* / Mesic Graminoids Shrubland (CEGL001203)--This type may be essentially the same, or this type is a later successional stage.
- *Salix interior* - *Salix eriocephala* Sandbar Shrubland (CEGL005078)--of the Great Lakes states/provinces.
- *Salix interior* Temporarily Flooded Shrubland (CEGL008562)--is a related type from the central states dominated by a different nominal *Salix* species.

GRank & Reasons: G5 (99-05-06). This type is widespread and common throughout its range.

Comments: This type may be an early successional shrubland that develops into *Salix exigua* / Mesic Graminoids Shrubland (CEGL001203), or the two types may be essentially synonymous. This plant association occupies a wide geographic range. The range of this type was reviewed and it was split into eastern, *Salix interior* Temporarily Flooded Shrubland (CEGL008562), and western components. The western stands may all be composed of *Salix exigua* (*sensu stricto*) and Great Plains stands may contain either *Salix exigua*, *Salix interior*, or intermediates of the two willow species, the *Salix interior* being an entirely Great Plains and eastwardly distributed species (Kartesz 1999).

ELEMENT DISTRIBUTION

Range: This willow shrubland community is found along rivers and streams at lower elevations throughout the northwestern United States and Great Plains, ranging sporadically from Oklahoma northwest to the Dakotas and Manitoba, and west to Washington. Part of this type's former range in the Great Plains and eastward is actually occupied, at least in part, by *Salix interior* [see *Salix interior* Temporarily Flooded Shrubland (CEGL008562)].

Nations: CA US

States/Provinces: CO:S?, ID:S3?, MB:S?, MT:S5, ND:S?, NE:S4S5, OK:S?, OR:S1, SD:S2, WA:S?, WY:S3Q

ELEMENT SOURCES

Authors: J.F. Drake, WCS **Confidence:** 1 **Identifier:** CEG001197

References: Bellah and Hulbert 1974, Bourgeron and Engelking 1994, Driscoll et al. 1984, Evenden 1990, Foti et al. 1994, Hansen et al. 1989, Hansen et al. 1991, Hansen et al. 1995, Hoagland 1998c, Hoagland 2000, Kartesz 1999, Kittel and Lederer 1993, Kovalchik 1987, Phillips 1977, Steinauer 1989, Steinauer and Rolfsmeier 2000, Wilson 1970

SALIX BEBBIANA TEMPORARILY FLOODED SHRUBLAND ALLIANCE Bebb's Willow Temporarily Flooded Shrubland Alliance

ALLIANCE CONCEPT

Summary: This alliance occurs along rivers and streams in the western Great Plains and Rocky Mountains. This alliance is a briefly flooded, scrub-shrub wetland on slightly to moderately alkaline soils, usually near low-gradient streams. The water table is well below the soil surface for over half the growing season. However, there are periods of several days to a few weeks when water is at the surface. These communities are typically dominated by a dense growth of shrubs 0.5-3 m tall. Multiple-stemmed trees and/or shrubs 0.5-5 m tall have 30-100% cover; single-stemmed trees have less than 30% cover. The most abundant species in the shrub layer are *Salix bebbiana*, *Salix scouleriana*, and *Salix lucida ssp. caudata* (= *Salix fendleriana*). Other species found in this stratum include *Betula occidentalis*, *Cornus sericea*, *Salix exigua*, *Salix fluviatilis*, and *Prunus virginiana*. The herbaceous layer often contains *Scirpus* spp., *Carex* spp., *Triglochin palustris*, *Calamagrostis canadensis*, and *Equisetum* spp. along the wetter margins of the alliance. In the drier areas *Gentianella amarella ssp. acuta* (= *Gentiana strictiflora*), *Prunella vulgaris*, *Pyrola asarifolia*, *Ranunculus macounii*, *Sanicula marilandica*, *Viola canadensis*, *Vicia americana*, and *Zizia aptera* (= *Zizia cordata*) are frequently present.

Environment: Communities within this *Salix bebbiana* alliance occur on temporarily flooded, low-gradient streams or along narrow alluvial terraces of canyons. Communities can also occur on broad, seep-fed meadows. Stream channels range from steep and narrow to wider, less steep, and moderately sinuous. Elevations range from 985 m in Montana to 3290 m in Colorado. The soils are highly stratified layers of sandy loams, clay loams, and silty clay typically with mottling near the surface. The soils can be deep, dark-colored silty clay loams with high organic content and mottling or shallow, becoming skeletal at about 25 cm depth. In the spring and early summer, soils are saturated for several days to weeks and then slowly dry out over the rest of the growing season. *Pinus ponderosa* - *Quercus gambelii* forests and *Populus tremuloides* woodlands occur on adjacent hillsides.

Vegetation: Vegetation in this alliance occurs in the western Great Plains and Rocky Mountains along rivers and streams. The vegetation is typically dominated by dense shrubs up to 6 m tall. *Salix bebbiana* forms a dense overstory with a tree-like growth form. *Salix boothii*, *Salix scouleriana*, *Alnus incana*, or *Salix lutea* are occasionally present in minor to moderate amounts. The most abundant species in the shrub layer in the Great Plains stands are *Betula occidentalis*, *Cornus sericea*, *Salix exigua*, *Salix fluviatilis*, and *Prunus virginiana*. The low-shrub layer in stands in the western United States include *Ribes inerme*, *Cornus sericea*, *Rosa woodsii*, and *Symphoricarpos oreophilus*. For the most part the herbaceous layer is dominated by hay grasses, graminoids and low-growing forbs (Padgett et al. 1989, Hansen 1995). The herbaceous layer in stands from the midwestern United States often contains *Scirpus* and/or *Schoenoplectus* spp., *Carex* spp., *Triglochin palustris*, *Calamagrostis canadensis*, and *Equisetum* spp. along the wetter margins of the stand. In the drier areas *Gentianella amarella ssp. acuta* (= *Gentiana strictiflora*), *Prunella vulgaris*, *Pyrola asarifolia*, *Ranunculus macounii*, *Sanicula marilandica*, *Viola canadensis*, *Vicia americana*, and *Zizia aptera* (= *Zizia cordata*) are frequently present.

Dynamics: The Montana stands within this *Salix bebbiana* alliance represent a browsing/grazing disclimax of the *Salix geyeriana*-, *Salix lutea*-, or *Salix drummondiana*-dominated habitat types (Hansen et al. 1995). *Salix bebbiana* seems to be a highly palatable willow. However, this high level of palatability does not tend to negatively affect the status of *Salix bebbiana* on a site. In fact, *Salix bebbiana* seems to have evolved a physiological tolerance to browsing and remains on a site under all but the most severe conditions, such as sustained long-term browsing. This tolerance to repeated browsing allows *Salix bebbiana* to increase. Willows less tolerant of browsing include *Salix geyeriana*, *Salix boothii*, *Salix lutea*, and *Salix drummondiana* (Hansen et al. 1995). *Salix bebbiana* sprouts rapidly following fire. Prescribed burning is a commonly used wildlife management tool to rejuvenate decadent communities dominated by *Salix bebbiana* (Hansen et al. 1995). The New Mexico stands (Dick-Peddie 1993) have been invaded by non-native species, e.g., *Tamarix* spp. and *Elaeagnus angustifolia*. Hay grasses were reported in the majority of plots from several studies.

Comments: This alliance has not been extensively described. Distinguishing characteristics beyond the dominance by *Salix bebbiana* and its relationship to other wetland shrub alliances are not well known.

ALLIANCE SOURCES

Authors: D. CULVER, West **Identifier:** A.971

References: Baker 1982b, Boggs et al. 1990, Dick-Peddie 1993, Faber-Langendoen et al. 1996, Hansen et al. 1988b, Hansen et al. 1991, Hansen et al. 1995, Hayward 1928, Kittel et al. 1999a, Padgett et al. 1988b, Padgett et al. 1989, Szaro 1989, TNC 1991b, Thilenius 1971

SALIX BEBBIANA SHRUBLANDBebb's Willow Shrubland

ELEMENT CONCEPT

Summary: This willow shrubland is found in the montane regions and western plains of the United States. This community is a briefly flooded scrub-shrub wetland on slightly to moderately alkaline soils, usually near low-gradient streams. This shrubland is typically dominated by a dense growth of shrubs 0.5-3 m tall. The most abundant species in the shrub layer are *Salix bebbiana*, *Salix scouleriana*, and *Salix lucida ssp. caudata* (= *Salix fendleriana*). Other species found in this strata include *Betula occidentalis*, *Cornus sericea ssp. sericea*, *Salix exigua*, *Salix melanopsis* (= *Salix fluviatilis*), and *Prunus virginiana*. Multiple-stemmed trees and/or shrubs 1.5-5 m tall have 30-100% cover; single-stemmed trees have less than 30% cover. The herbaceous layer often contains *Schoenoplectus* spp. (= *Scirpus* spp.), *Carex* spp., *Triglochin palustris*, *Calamagrostis canadensis*, and *Equisetum* spp. along the wetter margins of the community. In the drier areas *Gentianella amarella ssp. acuta* (= *Gentiana strictiflora*), *Prunella vulgaris*, *Pyrola asarifolia*, *Zizia aptera* (= *Zizia cordata*), *Sanicula marilandica*, *Viola canadensis*, *Vicia americana*, and *Ranunculus macounii* are frequently present.

Environment: Stands occur on slightly to moderately alkaline soils, usually near low-gradient streams. The water table is well below the soil surface for over half the growing season. However, there are brief periods of several days to a few weeks when water is at the surface.

Vegetation: This shrubland is typically dominated by a dense growth of shrubs 0.5-3 m tall. The most abundant species in the shrub layer are *Salix bebbiana*, *Salix scouleriana*, and *Salix lucida ssp. caudata* (= *Salix fendleriana*). Other species found in this strata include *Betula occidentalis*, *Cornus sericea ssp. sericea*, *Salix exigua*, *Salix fluviatilis*, and *Prunus virginiana*. Multiple-stemmed trees and/or shrubs 1.5-5 m tall have 30-100% cover; single-stemmed trees have less than 30% cover. The herbaceous layer often contains *Schoenoplectus* spp. (= *Scirpus* spp.), *Carex* spp., *Triglochin palustris*, *Calamagrostis canadensis*, and *Equisetum* spp. along the wetter margins of the community. In the drier areas *Gentianella amarella ssp. acuta* (= *Gentiana strictiflora*), *Prunella vulgaris*, *Pyrola asarifolia*, *Zizia aptera* (= *Zizia cordata*), *Sanicula marilandica*, *Viola canadensis*, *Vicia americana*, and *Ranunculus macounii* are frequently present.

Dynamics: Brief floods can occur in spring or after heavy rains.

GRank & Reasons: G3? (96-02-01). Most sites have been impacted by grazing.

Comments: The distribution and classification of this community need further investigation. Changes in historic natural processes, including flooding, and more recent human impacts, such as grazing, have altered this community.

ELEMENT DISTRIBUTION

Range: This beaked willow shrubland is found in the montane regions and western plains of the United States, ranging from South Dakota and Montana south to New Mexico.

Nations: US

States/Provinces: CO:S2, MT:S3?, NM:S?, SD:S2, WY:S2S3

ELEMENT SOURCES

Authors: J. Drake, WCS **Confidence:** 2 **Identifier:** CEGLO01173

References: Baker 1982b, Bourgeron and Engelking 1994, Cowardin et al. 1979, Dick-Peddie 1993, Driscoll et al. 1984, Hansen et al. 1991, Hayward 1928, Kittel et al. 1999a, Szaro 1989, Thilenius 1971

SALIX BOOTHII TEMPORARILY FLOODED SHRUBLAND ALLIANCEBooth's Willow Temporarily Flooded Shrubland Alliance

ALLIANCE CONCEPT

Summary: This widespread riparian shrubland alliance is found throughout the interior western U.S. between 1320-2800 m in elevation. Stands occur in valley bottoms, swales, streambanks, and occasionally terraces of stream channels in areas that have surface water present for only brief periods of time during the growing season, and are usually found within 1 m of the water table. Stands are also located adjacent to seeps on gently sloping toeslopes. The ground surface is often uneven and hummocky due to past flooding and beaver activity. The soils are variable and include highly stratified alluvium or fine-textured, highly organic soils. Shrublands within this alliance are dominated by *Salix boothii* with a canopy ranging from 20-80% cover. *Salix geyeriana*, *Salix lemmonii*, or *Salix drummondiana* may codominate. Other shrubs present include *Dasiphora fruticosa ssp. floribunda* (= *Pentaphylloides floribunda*) and *Betula nana* (= *Betula glandulosa*). A mixture of forbs and graminoids growing on raised hummocks characterizes the moderately dense herbaceous layer. Common forb and graminoid species include *Swertia perennis*, *Pedicularis groenlandica*, *Polygonum bistortoides*, *Heracleum maximum* (= *Heracleum lanatum*), *Achillea millefolium*, *Carex aquatilis*, *Carex utriculata*, and *Calamagrostis canadensis*. Diagnostic of

this riparian alliance is a *Salix boothii*-dominated or -codominated tall shrubland that is flooded for brief periods during the growing season and has a shallow water table.

Environment: Vegetation types in the *Salix boothii* Temporarily Flooded Shrubland Alliance (A.972) occur in valley bottoms on swales, banks, and occasionally terraces of stream channels, areas which have surface water present for only brief periods of time during the growing season. Stands are usually found within 1.0 m of the water table, but are occasionally located above the channel on low terraces of straight sections of rivers. Vegetation in the alliance is also located adjacent to seeps on gently sloping toeslopes. Elevation ranges from 1320-2800 m. The ground surface is often uneven and hummocky due to past flooding and beaver activity.

Soils are typically highly stratified with alternating layers of sandy loam and clay loam and are mottled within the top 10 cm. Other soils are finely textured, dark-colored, highly organic soils with silty clay loam. Lower profiles typically contain a gravel or cobble layer which may indicate that the soil section is a silted-in beaver pond (Kittel et al. 1999).

Mixed conifer-*Populus tremuloides* and *Populus tremuloides* forests often occur on adjacent hillslopes at higher elevations, and *Artemisia tridentata* scrub occurs on adjacent hillsides at lower elevations.

Vegetation: The tall-shrub layer is dominated by large stands of *Salix boothii* with a canopy ranging from 20-80% cover. Several stands are codominated (35-50% cover) by *Salix geyeriana*, *Salix lemmonii*, or *Salix drummondiana*. Other shrubs present include *Dasiphora fruticosa* ssp. *floribunda* (= *Pentaphylloides floribunda*) and *Betula nana* (= *Betula glandulosa*). The herbaceous layer is characterized by a moderate forb layer growing on raised hummocks. No one forb species is dominant, but rather several species have a combined cover of 40-60%. Forb species include *Swertia perennis*, *Pedicularis groenlandica*, *Polygonum bistortoides*, *Heracleum maximum* (= *Heracleum lanatum*), and *Achillea millefolium*. Graminoid cover is moderate (<40%) and commonly includes *Carex aquatilis*, *Carex utriculata*, and *Calamagrostis canadensis*.

Dynamics: Stands within this alliance are dominated by *Salix boothii* which is often highly productive. Understory production varies, depending on the density of overstory shrubs. Thick shrub stands make access by livestock difficult, therefore stands within this alliance are somewhat resistant to grazing effects (Youngblood et al. 1985b).

ALLIANCE SOURCES

Authors: D. CULVER, West **Identifier:** A.972

References: Dorn 1997, Girard et al. 1997, Johnston 1987, Kagan 1997, Kettler and McMullen 1996, Kittel and Lederer 1993, Kittel et al. 1994, Kittel et al. 1995, Kittel et al. 1999a, Kovalchik 1987, Manning and Padgett 1991, Mutz and Graham 1982, Mutz and Queiroz 1983, Norton et al. 1981, Padgett et al. 1988b, Padgett et al. 1989, Reid 1990, Sawyer and Keeler-Wolf 1995, Tuhy and Jensen 1982, Weixelman et al. 1996, Youngblood et al. 1985a, Youngblood et al. 1985b

SALIX BOOTHII / CAREX UTRICULATA SHRUBLAND Booth's Willow / Beaked Sedge Shrubland

ELEMENT CONCEPT

Summary: In Colorado, this riparian shrubland occurs in the wettest micro-habitats of the floodplain, including low floodplains adjacent to beaver ponds and low areas between beaver dams. The ground is very wet, and the water table is at or near the soil surface all season long. Stands have a short to tall (1-4 m), closed, broad-leaved, deciduous shrub canopy that is dominated by *Salix boothii* with an herbaceous layer of *Carex utriculata*. Information on stands that occur outside Colorado will be added later.

GRank & Reasons: G4 (96-02-01).

ELEMENT DISTRIBUTION

Range:

Nations: US

States/Provinces: CA?, CO:S3, ID:S4, OR:S3, UT:S3?, WY:S2S3

ELEMENT SOURCES

Authors: WCS **Confidence:** 1 **Identifier:** CEG001178

References: Bourgeron and Engelking 1994, Driscoll et al. 1984, Kettler and McMullen 1996, Kittel and Lederer 1993, Kittel et al. 1994, Kittel et al. 1999a, Kovalchik 1987, Mutz and Graham 1982, Mutz and Queiroz 1983, Norton et al. 1981, Padgett et al. 1988b, Padgett et al. 1989, Tuhy and Jensen 1982, Youngblood et al. 1985a, Youngblood et al. 1985b

SALIX BOOTHII / MESIC GRAMINOIDS SHRUBLAND Booth's Willow / Mesic Graminoids Shrubland

ELEMENT CONCEPT

Summary: This riparian community is currently known from Colorado, Idaho, Utah, and may also occur in Wyoming and Montana. Stands occur on moist stream terraces with slopes of 1-8% and elevation ranges of 2040-2260 m (6700-7400 feet) in Montana and as high as 2990 m (9800 feet) in Utah. Higher elevation occurrences may occur at lower latitudes. Community structure consists of a shrub layer dominated by *Salix boothii*, *Salix drummondiana*, and/or *Salix monticola*.

While *Salix geyeriana* may codominate in some stands, *Salix lucida* ssp. *lasiandra* (= *Salix lasiandra*), *Salix exigua*, or *Salix brachycarpa* may be present, but are never abundant. Total graminoid cover ranges from 10-55% and exceeds that of total forb cover. No single species is particularly dominant over the others, and no one species is present in every stand. The sparse to dense understory of graminoids commonly includes *Carex pellita* (= *Carex lanuginosa*), *Carex microptera*, *Juncus balticus*, *Glyceria striata*, *Agrostis stolonifera*, and *Deschampsia caespitosa*. Minor understory components may include *Poa pratensis*, *Poa palustris*, *Calamagrostis canadensis*, and *Carex utriculata*. This association is distinguished from the *Salix boothii* / Mesic Forbs Shrubland (CEGL001180) by having a higher cover of graminoid species. Stands with predominantly non-native graminoid species in the undergrowth are considered grazing-induced.

Similar Associations:

- *Salix boothii* / Mesic Forbs Shrubland (CEGL001180)

GRank & Reasons: G3? (99-12-06). This association is known over a broad range including Colorado, Utah, Idaho, and possibly Wyoming and Montana. There are at least 21 known occurrences with at least 75 to 100 more expected. Invasion by non-native herbaceous species is cited as the greatest threat to this community. In mid-montane locations with low gradients, impacts from development in the riparian zone may alter this community.

Comments: Hansen et al. (1988) lumped *Salix boothii* communities into the *Salix geyeriana* types due to similarities in environmental settings and management concerns. Both communities contain stands where *Salix boothii* is the dominant shrub. Differences in the understory composition are dependent on the specific substrate and moisture regime.

ELEMENT DISTRIBUTION

Range: This riparian community is currently known from major runoff dominated rivers in Colorado, Idaho, Utah, and may also occur in Wyoming and Montana.

Nations: US

States/Provinces: CO:S3, ID:S3?, MT?, UT:S3?, WY?

ELEMENT SOURCES

Authors: J. Thompson and J. Stevens, WCS **Confidence:** 1 **Identifier:** CEGL001181

References: Bourgeron and Engelking 1994, Driscoll et al. 1984, Hansen et al. 1995, Padgett et al. 1988b, Padgett et al. 1989, Reid 1990

SALIX GEYERIANA TEMPORARILY FLOODED SHRUBLAND ALLIANCE Geyer's Willow Temporarily Flooded Shrubland Alliance

ALLIANCE CONCEPT

Summary: Communities within this riparian shrubland alliance occur from the foothills to high elevations in the mountains of the western United States. Elevation ranges from 1320-2900 m. Landforms include broad benches and alluvial terraces of streams, springs, and seeps. Stands often develop on abandoned and sediment-filled beaver ponds. Soils are composed of deep, fine-textured alluvium over subsurface soils of various textures and origin. Soils have a high water-holding capacity. A tall-shrub layer dominated by *Salix geyeriana* characterizes these communities. Occasional codominants include *Salix monticola*, *Salix boothii*, *Salix lemmonii*, or *Salix eriocephala*. Some stands have shorter willows in the understory, including *Salix wolfii* and *Salix planifolia*. Other shrub species include *Lonicera utahensis*, *Dasiphora fruticosa* ssp. *floribunda* (= *Pentaphylloides fruticosa*), and *Ribes* spp. *Calamagrostis canadensis*, *Calamagrostis stricta*, *Poa palustris*, *Deschampsia caespitosa*, *Carex aquatilis*, and *Carex utriculata* are the dominant graminoid species with 10-60% cover. The forb layer is minor with 10-20% cover and includes *Geum macrophyllum*, *Pyrola asarifolia*, *Galium trifidum*, and *Epilobium ciliatum*. *Populus tremuloides*, *Pinus contorta*, and *Pinus ponderosa* forests occur on surrounding hillslopes.

Environment: Communities within this alliance occur from the foothills to high elevations in the mountains of the western United States. Elevation ranges from 1320-2900 m. Landforms include broad benches and alluvial terraces of streams, springs, and seeps. Stands often develop on abandoned and sediment-filled beaver ponds. Soils are composed of deep, fine-textured alluvium over subsurface soils of various textures and origin. Surface textures are sandy to sandy clay loam with mottling near the surface. Soils have a high water-holding capacity. *Populus tremuloides*, *Pinus contorta*, and *Pinus ponderosa* forests occur on surrounding hillslopes.

Vegetation: Communities within this alliance are classified as temporarily flooded cold-deciduous shrublands. These communities are characterized by a tall-shrub layer dominated by *Salix geyeriana*. Occasional codominants include *Salix monticola*, *Salix boothii*, *Salix lemmonii* or *Salix eriocephala*. Some stands have shorter willows in the understory, including *Salix wolfii* and *Salix planifolia*. Other shrub species include *Lonicera utahensis*, *Dasiphora fruticosa* ssp. *floribunda* (= *Pentaphylloides fruticosa*), and *Ribes* spp. *Calamagrostis canadensis*, *Calamagrostis stricta*, *Poa palustris*, *Deschampsia caespitosa*, *Carex aquatilis*, and *Carex utriculata* are the dominant graminoid species with 10-60% cover. The forb layer is minor with 10-20% cover and includes *Geum macrophyllum*, *Pyrola asarifolia*, *Galium trifidum*, and *Epilobium ciliatum*.

Dynamics: Characteristics of the herbaceous layer and soils suggest that many of the vegetation types within this alliance are stable (Youngblood et al. 1985b). However, livestock grazing pressure will cause a decrease in the native graminoids (Hansen et al. 1995).

ALLIANCE SOURCES

Authors: D. CULVER, West **Identifier:** A.975

References: Baker 1986, Baker 1989b, Cooper and Cottrell 1990, Hallock et al. 1986, Hansen et al. 1995, Hess 1981, Jensen and Tuhy 1981, Johnston 1987, Jones 1992b, Kagan 1997, Kearney and Peebles 1969, Kettler and McMullen 1996, Kittel and Lederer 1993, Kittel et al. 1994, Kittel et al. 1995, Kittel et al. 1999a, Kovalchik 1987, MTNHP n.d., Mutz and Queiroz 1983, Norton et al. 1981, ORNHP unpubl. data n.d., Padgett and Manning 1988, Padgett et al. 1988b, Padgett et al. 1989, Phillips 1977, Tuhy and Jensen 1982, Youngblood et al. 1985a, Youngblood et al. 1985b

SALIX GEYERIANA / MESIC GRAMINOIDS SHRUBLAND Geyer's Willow / Mesic Graminoids Shrubland

ELEMENT CONCEPT

Summary: This is an important association in Idaho, Oregon, Montana, Utah, Colorado, and northwestern Wyoming. Stands of this association are often found in wide mountain valleys, cirques, and troughs, at elevations from about 1525 to 2745 m (5000-9000 feet) with narrow, meandering streams or braided rivers. The association mainly occurs on seasonally saturated or flooded sites such as streambanks, terraces, floodplains, abandoned meanders, spring-fed meadows, lake or reservoir shores, and occasionally alluvial gravel bars. Soils vary but are mostly silt to clay loams with organic/sedge peat horizons. An open canopy of tall, clumped *Salix geyeriana*, with occasionally intermixed *Salix boothii* (with less than 20% cover), characterizes this association. Other shrubs, including *Dasiphora fruticosa* ssp. *floribunda*, *Ribes* spp., *Rosa woodsii*, and low *Salix* spp., are scattered around the bases of taller *Salix* clumps. The herbaceous understory is dominated by a diverse mix of mesic graminoid species that always has greater total cover than the total cover of mesic forbs. In good condition, mid- to late-seral stands, the most common graminoids are *Carex microptera*, *Carex pellita*, *Deschampsia caespitosa*, and occasionally *Carex nebrascensis*, but no single species consistently has high cover. Other graminoids, with moderate cover and constancy, include *Calamagrostis canadensis*, *Carex aquatilis*, *Carex rostrata*, *Glyceria* spp., and *Juncus balticus*. *Poa pratensis* is present in nearly all stands, but its cover varies depending on the amount of grazing disturbance and site desiccation. The most common forb species are sometimes indicative of grazing disturbance (e.g., *Achillea millefolium*, *Geum macrophyllum*, *Iris missouriensis*, *Maianthemum stellatum*, *Potentilla gracilis*, *Thalictrum* spp., *Taraxacum officinale*, and *Trifolium* spp.).

Dynamics: The high cover of grasses and sedges makes this association highly productive for livestock forage. In addition, this association has many corridors between willow clumps that allow for livestock access (Padgett et al. 1989, Hansen et al. 1995, Walford et al. 2001). These attributes make this type susceptible to overgrazing and conversion of the understory from native species to exotic grasses. While stands do exist in less disturbed, late-seral states with native understory species, it is more often expressed as disturbance-induced (e.g., by livestock grazing) states (Padgett et al. 1989, Manning and Padgett 1995, Weixelman et al. 1996, Walford et al. 2001). Similarly, understory shrub and forb composition may be the result of grazing disturbance (Weixelman et al. 1996, Hansen and Hall 2002). Thus, it is hypothesized that under persistent, heavy livestock grazing the association will move toward *Salix geyeriana* / *Poa pratensis*, *Salix geyeriana* / *Poa palustris*, *Salix geyeriana* / mesic graminoid-forb, or *Salix geyeriana* / mesic forbs (Youngblood et al. 1985a, Evenden 1990, Padgett et al. 1989, Walford et al. 2001). Overgrazing may directly or indirectly eliminate *Salix geyeriana* by decreasing its vigor or altering hydrologic conditions (Hansen and Hall 2002). The resulting associations may be drier types such as *Poa pratensis* meadows, or other associations. Alternatively, *Salix geyeriana* / mesic graminoids possibly originated from *Salix geyeriana* / *Calamagrostis canadensis*, *Salix geyeriana* / *Carex aquatilis*, *Salix geyeriana* / *Carex rostrata*, or *Salix geyeriana* / *Deschampsia caespitosa* associations which have been disturbed by grazing, or alterations in hydrology, and subsequently invaded by various mesic graminoid species (Mutz and Queiroz 1983, Youngblood et al. 1985a, Padgett et al. 1989, Hansen et al. 1995, Manning and Padgett 1995, Hansen and Hall 2002, Walford et al. 2001, IDCDC 2002).

GRank & Reasons: G3? (02-10-22). This association is widely distributed at mid to high elevations, ranging from the Great Basin to the Central Rockies, north to central and eastern Idaho and adjacent Wyoming. Extensive stands of the association are relatively frequently observed in a wide variety of fluvial settings, but they are especially common on seasonally wet sites in wide montane valley bottoms (e.g., glacial troughs and basins). This association is distinguished by having moderate cover and constancy of mixed mesic graminoid species, none of which are distinctly dominant. The high cover of mesic graminoids under an open *Salix geyeriana* canopy makes this association susceptible to overgrazing by livestock and conversion of the understory to dominance by exotic grasses (e.g., *Poa pratensis*). While stands of this type do exist in less disturbed, late-seral states with native understory species, the association is more often expressed as disturbance-induced stands. If stands in poor to fair ecological condition with understories dominated by exotic grass species are not considered, the total known occurrences of this association is probably less than 100. Unfortunately, this is a broadly defined type that sometimes encompasses *Salix geyeriana* / *Poa pratensis* and other disturbance-induced *Salix geyeriana* stands with no clearly dominant understory graminoid species. In addition, some stands dominated by *Salix boothii* are also included

within this association based on similarities in environmental setting and composition. This broad lumping is problematic for determining a clear definition of this association and assessing its true extent across its range. More in-depth analysis of existing stand data needs to occur in order to determine the actual number of occurrences. Until this occurs, G3? is an appropriate rank.

Comments: This association has a high cover and constancy of *Poa pratensis* and may be anthropogenic. This is a widespread, well-sampled association. It has been sampled throughout eastern Idaho (5 plots by Youngblood et al. 1985a; 2 plots by Padgett et al. 1989) and across central Idaho (at least 6 plots) (IDCDC 2002). The association has been sampled in northwestern Wyoming (6 plots by Walford et al. 2001), Utah (4 plots by Padgett et al. 1989), northern and central Nevada (9 plots by Manning and Padgett 1995). An unknown portion of 71 plots sampled in Montana (Hansen et al. 1995) and 58 plots sampled in southeastern Idaho (Hansen and Hall 2002) of a broader *Salix geyeriana* community type likely include stands fitting this association. When ecological conditions are good, this type is clearly distinguished from other *Salix geyeriana*-dominated stands by having moderate cover and constancy of mixed native mesic graminoid species including (but not limited to) *Calamagrostis canadensis*, *Carex aquatilis*, *Carex pellita*, *Carex utriculata*, and/or *Deschampsia caespitosa*, none of which are distinctly dominant. This can cause confusion with *Salix geyeriana* associations named for dominance of any one of these species (Mutz and Queiroz 1983, Youngblood et al. 1985a, Padgett et al. 1989, Hansen et al. 1995, Manning and Padgett 1995, Walford et al. 2001, Hall and Hansen 2002, Crowe et al. 2002). This association is a broadly defined type that encompasses *Salix geyeriana* / *Poa pratensis* (as in Padgett et al. 1989) and other disturbance-induced *Salix geyeriana* stands with no clearly dominant understory graminoid species (as in Evenden 1990). Some stands dominated by *Salix boothii* are also included based on similarities in environmental setting and composition (Hansen et al. 1995, Hansen and Hall 2002). This broad lumping is problematic for determining a clear definition of this association and assessing its true extent.

ELEMENT DISTRIBUTION

Range: This association is widely distributed in the West at mid to high elevations, ranging from Idaho, Wyoming, Utah, Nevada, Colorado, and possibly California, Montana and Oregon.

Nations: US

States/Provinces: CO:S3, ID:S?, NV:S?, UT:S2S3

ELEMENT SOURCES

Authors: C. Murphy, WCS **Confidence:** 2 **Identifier:** CEGLO01210

References: Bourgeron and Engelking 1994, Crowe et al. 2002, Driscoll et al. 1984, Evenden 1990, Hansen and Hall 2002, Hansen et al. 1995, IDCDC 2002, Kettler and McMullen 1996, Kittel and Lederer 1993, Kittel et al. 1994, Kittel et al. 1995, Kittel et al. 1999a, Kovalchik 2001, Manning and Padgett 1995, Mutz and Queiroz 1983, Norton et al. 1981, Padgett et al. 1988b, Padgett et al. 1989, Walford et al. 2001, Weixelman et al. 1996, Youngblood et al. 1985a

SALIX LUTEA TEMPORARILY FLOODED SHRUBLAND ALLIANCE Yellow Willow Temporarily Flooded Shrubland Alliance

ALLIANCE CONCEPT

Summary: Communities within this cold-deciduous, temporarily flooded shrubland alliance occur on alluvial terraces adjacent to mountain rivers and streams. They occupy broad floodplains (0-6% slope), stream and river edges, ditches, seeps, and moist alluvial terraces. Elevations range from 1100-3600 m. Soils on the alluvial terraces are usually a deep silt or sand. These soils are saturated early in spring and often remain moist throughout the growing season. The tall-shrub canopy is continuous and dominated by *Salix lutea* with varying amounts of *Salix exigua*, *Salix bebbiana*, and *Salix boothii*. The short-shrub layer's cover is typically 25% or greater and consists of *Ribes aureum*, *Ribes inerme*, and *Rosa woodsii*. The graminoid layer ranges from sparse to dense canopy cover. Major herbaceous species include *Calamagrostis canadensis*, *Carex utriculata*, *Calamagrostis stricta*, and *Carex microptera*.

Environment: Communities within this alliance occur on alluvial terraces adjacent to mountain rivers and streams. They occupy broad floodplains (0-6% slope), stream and river edges, ditches, seeps, and moist alluvial terraces. Elevations range from 1100-3600 m. Soils can range from Entisols to Mollisols. Soils on the alluvial terraces are usually a deep silt or sand. Stands adjacent to stream channels consist of a thin sandy loam overlying gravel or cobbles. These soils are saturated early in spring and often remain moist throughout the growing season. Adjacent upland communities include forests dominated by *Pinus contorta* and *Populus tremuloides*.

Vegetation: Vegetation types within this alliance are characterized as cold-deciduous, temporarily flooded shrublands. The tall-shrub canopy is continuous and dominated by *Salix lutea* with varying amounts of *Salix exigua*, *Salix bebbiana*, and *Salix boothii*. The short-shrub layer's cover is typically 25% or greater and consist of *Ribes aureum*, *Ribes inerme*, and *Rosa woodsii*. The graminoid layer ranges from sparse to dense percent cover. Major herbaceous species include *Calamagrostis canadensis*, *Carex utriculata*, *Calamagrostis stricta*, and *Carex microptera*.

Dynamics: If browsing pressure is heavy, willow coverages will decrease, resulting in more open communities. Grazing pressure by livestock will cause a decrease in the more desirable grasses with a corresponding increase in weedy species such as *Phleum pratense*, *Poa pratensis*, and *Agrostis stolonifera*.

Comments: The taxonomy for the dominant species in this alliance is under discussion; the accepted name for *Salix lutea* is *Salix eriocephala* var. *watsonii* according to Dorn (1997). For the purposes of this description the name *Salix lutea* will be used (Kartesz 1999).

ALLIANCE SOURCES

Authors: D. CULVER, West **Identifier:** A.980

References: Dorn 1997, Evenden 1990, Great Plains Flora Association 1986, Hansen et al. 1991, Hansen et al. 1995, Kagan 1997, Kartesz 1999, Kearney and Peebles 1969, Manning and Padgett 1992, Manning and Padgett 1995, Padgett 1982, Sawyer and Keeler-Wolf 1995

SALIX WOLFII TEMPORARILY FLOODED SHRUBLAND ALLIANCE Wolf Willow

Temporarily Flooded Shrubland Alliance

ALLIANCE CONCEPT

Summary: Communities within this cold-deciduous shrubland alliance occur in wide mountain valleys. Elevation ranges from 1950-3000 m. Stands occur along first- or second-order streams on well-drained slopes and on hummocks on the valley floor. The water table is usually within the top meter of soil, and groundwater slowly seeps to the surface. Stream channels are narrow, relatively deep and sinuous. Soils may be saturated in the spring and early summer, but dry somewhat during the summer as the water table drops. Soil textures often have a high organic content. *Salix wolfii* dominates the short-shrub layer with 20-100% cover. Other shrub species present include 0-80% cover of *Dasiphora fruticosa* ssp. *floribunda* (= *Pentaphylloides floribunda*), *Salix planifolia*, *Salix boothii*, *Salix geeyeriana*, and *Salix brachycarpa*. Graminoid species are diverse, yet generally have a low cover. Graminoid species include 0-40% cover of *Deschampsia caespitosa* and *Poa palustris* and 0-10% cover each of *Calamagrostis canadensis* and various *Carex* species. Forb cover is variable with no single dominant species. Forb species include *Mertensia ciliata*, *Senecio triangularis*, *Ligusticum porteri*, *Fragaria virginiana*, *Cardamine cordifolia*, *Geum macrophyllum*, and *Heracleum maximum* (= *Heracleum lanatum*).

Environment: Communities within this alliance occur in wide mountain valleys. Elevation ranges from 1950-3000 m. Stands occur along first- or second-order streams on well-drained slopes and on hummocks on the valley floor. The water table is usually within the top meter of soil, and groundwater slowly seeps to the surface. Stream channels are narrow, relatively deep and sinuous. Soils may be saturated in the spring and early summer, but dry somewhat during the summer as the water table drops. Soil textures often have a high organic content and are silty clays, silty clay loams, silty loams, or deep sandy clays, clay loams, and sandy clay loams over gravels and rocks.

Abies lasiocarpa - *Picea engelmannii*, *Pinus contorta*, and *Populus tremuloides* forests occur on steep-sided slopes. In broad valleys, *Artemisia tridentata* scrub and *Festuca thurberi* subalpine meadows occur outside of riparian areas.

Vegetation: Communities within this alliance are defined as cold-deciduous shrublands. *Salix wolfii* dominates the short-shrub layer with 20-100% cover. Other shrub species present include 0-80% cover of *Dasiphora fruticosa* ssp. *floribunda* (= *Pentaphylloides floribunda*), *Salix planifolia*, *Salix boothii*, *Salix geeyeriana*, and *Salix brachycarpa*. Graminoid species are diverse, yet generally have a low cover. Graminoid species include 0-40% cover of *Deschampsia caespitosa* and *Poa palustris* and 0-10% cover each of *Calamagrostis canadensis* and various *Carex* species. Forb cover is variable with no single dominant species. Forb species include *Mertensia ciliata*, *Senecio triangularis*, *Ligusticum porteri*, *Fragaria virginiana*, *Cardamine cordifolia*, *Geum macrophyllum*, and *Heracleum maximum* (= *Heracleum lanatum*).

Dynamics: Browsing may weaken or eventually eliminate *Salix wolfii*. With increasing levels of grazing, *Deschampsia caespitosa* will be replaced by *Juncus balticus*, *Poa pratensis*, and *Taraxacum officinale*.

ALLIANCE SOURCES

Authors: D. CULVER, West **Identifier:** A.983

References: Baker 1989b, Girard et al. 1997, Hansen et al. 1991, Hansen et al. 1995, Hitchcock et al. 1964, Jensen and Tuhy 1981, Johnston 1987, Jones 1992b, Kettler and McMullen 1996, Kittel and Lederer 1993, Kittel et al. 1994, Kittel et al. 1999a, Mattson 1984, Mutz and Queiroz 1983, Padgett et al. 1988b, Padgett et al. 1989, Phillips 1977, Sanderson and Kettler 1996, Tuhy and Jensen 1982, Youngblood et al. 1985a, Youngblood et al. 1985b

SALIX WOLFII / DESCHAMPSIA CAESPITOSA SHRUBLAND Wolf Willow / Tufted Hairgrass Shrubland

ELEMENT CONCEPT

Summary: This is a minor plant association with a widespread distribution including mid to upper elevations throughout the Rocky Mountains. The association is found in meadows, on lower toeslopes, and on benches or terraces in broad valley bottoms. *Salix wolfii* creates a dense, low overstory with *Dasiphora fruticosa* ssp. *floribunda* (= *Potentilla fruticosa*)

frequently present. *Deschampsia caespitosa* is the diagnostic graminoid with up to 10% cover. A diverse mix of other graminoids and forbs are usually present, including *Juncus balticus*, *Danthonia intermedia*, *Phleum alpinum*, *Potentilla gracilis*, and *Senecio integerrimus*.

GRank & Reasons: G3 (00-10-20). The quality of remaining stands of this plant association has been compromised because of changes in hydrology and shifts in species composition. Beaver frequently play a role in the maintenance of the hydrology associated with sites dominated by *Salix wolfii*. Removal of beaver and stream downcutting have lowered water tables in many of the areas where this association formerly occurred. In some locations this has changed the site potential to one that supports upland associations. This is one of the driest of the *Salix wolfii* types and is accessible to livestock (sheep and cattle) throughout much of the growing season. Improper livestock grazing may contribute to channel downcutting and result in replacement of *Deschampsia caespitosa* with species that increase with grazing pressure (*Juncus balticus*, *Carex nebrascensis*, and *Fragaria virginiana*) and exotic species (*Poa pratensis*, *Agrostis scabra*, and *Taraxacum officinale*).

Comments: This plant association has been described in numerous classifications. The difficulty in classification comes when stands are disturbed and the diagnostic understory species, *Deschampsia caespitosa*, is only present with low cover and exotic grasses dominate the stand.

ELEMENT DISTRIBUTION

Range: This is a minor type in Utah, Wyoming, Idaho and Montana.

Nations: US

States/Provinces: ID:S2, MT:S3, UT:S2S3, WY:S2S3

ELEMENT SOURCES

Authors: M. Jankovsky-Jones, WCS **Confidence:** 1 **Identifier:** CEG001238

References: Bourgeron and Engelking 1994, Driscoll et al. 1984, Hansen et al. 1991, Hansen et al. 1995, Padgett et al. 1988b, Padgett et al. 1989, Youngblood et al. 1985a, Youngblood et al. 1985b

SHEPHERDIA ARGENTEA TEMPORARILY FLOODED SHRUBLAND ALLIANCESilver Buffaloberry Temporarily Flooded Shrubland Alliance

ALLIANCE CONCEPT

Summary: This alliance, found in the northern Great Plains, is a shrubland found in dry landscapes. This alliance is found on stream terraces, rolling uplands, and badlands. It occurs where moisture is more plentiful than on the surrounding landscape, such as in swales, ravines, near streams, and on northwest- to east-facing slopes. This trend is more pronounced in Wyoming where this alliance is found only near streams and may be less pronounced in Saskatchewan and northern Montana. Soils are loamy sand, sandy loam, silty loam, or loam and are derived from glacial drift, siltstone, or sandstone. This alliance does not flood often, but some sites show evidence of a high water table.

The alliance is dominated by a moderate to dense canopy of medium-tall shrubs. The most abundant of these, *Shepherdia argentea*, is typically 1.5-3 m tall. Other species commonly in the shrub layer are *Juniperus horizontalis*, *Prunus virginiana*, *Ribes* spp., *Rhus aromatica*, *Rosa woodsii*, and *Symphoricarpos occidentalis*. Herbaceous species are less important in this community. Grass species, such as *Bromus inermis*, *Bromus tectorum*, *Calamagrostis montanensis*, *Leymus cinereus*, *Pascopyrum smithii*, and *Poa pratensis*, and forbs, such as *Achillea millefolium*, *Cirsium arvense*, *Galium boreale*, *Maianthemum stellatum*, *Parietaria pensylvanica*, and *Solidago* spp., may have only half the coverage as the shrub layer. Stands of this alliance are usually small, occurring in a predominantly prairie landscape either as small thickets or narrow bands along streams.

Environment: The vegetation in this alliance occurs in riparian habitats in the Rocky Mountains and in moist swales in the glaciated region of the northern Great Plains. It occurs where moisture is more plentiful than on the surrounding landscape, such as in swales, ravines, near streams, and on northwest- to east-facing slopes (Hansen and Hoffman 1988, DeVelice et al. 1995). This trend is more pronounced in Wyoming where Jones and Walford (1995) found this alliance only near streams and may be less pronounced in Saskatchewan and northern Montana. Stands are located on terraces above the floodplain of large rivers, on small and intermittent creeks, and on hillsides below springs or seeps in the Rockies and in moist depressions in rolling, prairie uplands. Stands are found between 500-1600 m elevation on the plains and in the northern Rockies and between 1950-2150 m in Colorado. Soils are classified predominantly as Entisols (Fluvents) or Mollisols (Borolls). Soil textures range from well-drained loamy sands to somewhat poorly drained silty clay loams and are derived from glacial drift, siltstone, or sandstone (USFS 1992, DeVelice et al. 1995). The vegetation is tolerant of brief flooding. Adjacent riparian vegetation includes *Acer negundo*, *Fraxinus pennsylvanica*, *Populus angustifolia*, *Populus deltoides*, and *Salix amygdaloides* woodlands and *Cornus sericea* and *Salix exigua* shrublands.

Vegetation: The vegetation in this alliance occurs in riparian habitats in the Rocky Mountains and moist swales in the northern Great Plains. *Shepherdia argentea* dominates the upper shrub canopy and occurs in small, open patches or in narrow bands parallel to a stream channel. *Symphoricarpos occidentalis* is often present in a lower shrub layer, and *Juniperus horizontalis*, *Prunus virginiana*, *Rhus aromatica*, *Ribes* spp., and *Rosa woodsii* occur in some stands. Native and exotic

herbaceous species occur in the understory and form a sparse to dense ground cover. Grass species, such as *Bromus inermis*, *Bromus tectorum*, *Calamagrostis montanensis*, *Leymus cinereus*, *Pascopyrum smithii*, and *Poa pratensis*, and forbs, such as *Achillea millefolium*, *Cirsium arvense*, *Galium boreale*, *Maianthemum stellatum*, *Parietaria pensylvanica*, and *Solidago* spp. are present in different stands (Hansen and Hoffman 1988, USFS 1992). DeVelice et al. (1995) stated that stands in northeastern Montana were typically smaller than 0.1 ha.

Comments: Stands of this alliance are usually easy to differentiate from the surrounding prairie landscape based solely on the shrubland physiognomy. There may be some difficulty classifying stands that contain an abundance of *Symphoricarpos occidentalis* with moderate amounts of *Shepherdia argentea* and other taller shrubs. These may be in either the *Shepherdia argentea* Temporarily Flooded Shrubland Alliance (A.960) or the *Symphoricarpos occidentalis* Temporarily Flooded Shrubland Alliance (A.961).

ALLIANCE SOURCES

Authors: M. DAMM, West **Identifier:** A.960

References: DeVelice et al. 1995, Faber-Langendoen et al. 1996, Hansen and Hoffman 1988, Hansen et al. 1984, Hansen et al. 1988a, Hansen et al. 1991, Hansen et al. 1995, Jones and Walford 1995, Kittel and Lederer 1993, Kittel et al. 1994, Kittel et al. 1999a, USFS 1992, Welsh et al. 1987

SHEPHERDIA ARGENTEA SHRUBLAND Silver Buffaloberry Shrubland

ELEMENT CONCEPT

Summary: This mesic buffaloberry shrubland community is found in the northern Great Plains of the United States and Canada. Stands occur on stream terraces, rolling uplands, and badlands, and where moisture is more plentiful than on the surrounding landscape, such as in swales, ravines, near streams, and on northwest- to east-facing slopes. The vegetation is dominated by a moderate to dense canopy of medium-tall shrubs. The most abundant of these, *Shepherdia argentea*, is typically 1.5-3 m tall. Other common shrub species are *Juniperus horizontalis*, *Prunus virginiana*, *Ribes* spp., *Rhus aromatica*, *Rosa woodsii*, and *Symphoricarpos occidentalis*. Graminoids and forbs may have only half the coverage of the shrub layer. Graminoids include *Poa pratensis*, *Pascopyrum smithii*, and *Bromus* spp. Common forbs are *Achillea millefolium*, *Artemisia ludoviciana*, and *Parietaria pensylvanica*. This community occurs in a predominantly prairie landscape as either narrow bands along streams or in small thickets.

Environment: This community is found on stream terraces, rolling uplands, and badlands. It occurs where moisture is more plentiful than on the surrounding landscape, such as in swales, ravines, near streams, and on northwest- to east-facing slopes (Hansen and Hoffman 1988, DeVelice et al. 1995). This trend is more pronounced in Wyoming where Jones and Walford (1995) only found this community near streams, and it may be less pronounced in Saskatchewan and northern Montana. Soils are loamy sand, sandy loam, silty loam, or loam and are derived from glacial drift, siltstone, or sandstone (USFS 1992, DeVelice et al. 1995). This community does not flood often, but some sites show evidence of a high water table (DeVelice et al. 1995).

Vegetation: The vegetation is dominated by a moderate to dense canopy of medium-tall shrubs. The most abundant of these, *Shepherdia argentea*, is typically 1.5-3 m tall. Other species commonly found in the shrub layer are *Juniperus horizontalis*, *Prunus virginiana*, *Ribes* spp., *Rhus aromatica*, *Rosa woodsii*, and *Symphoricarpos occidentalis*. Herbaceous species are not important in this community. Graminoids and forbs may have only half the coverage of the shrub layer (Hansen and Hoffman 1988, USFS 1992). Graminoids include *Poa pratensis*, *Pascopyrum smithii*, and *Bromus* spp. Common forbs are *Achillea millefolium*, *Artemisia ludoviciana*, and *Parietaria pensylvanica*. Litter may accumulate in this community (DeVelice et al. 1995).

Similar Associations:

- *Fraxinus pennsylvanica* - *Ulmus americana* / *Prunus virginiana* Woodland (CEGL000643)--The similarity is based on overall composition, but there are few *Fraxinus pennsylvanica* individuals in CEGL001128.

GRank & Reasons: G3G4 (96-02-01). The number of occurrences is unknown. The community is reported from Montana (where it is ranked S3?), Wyoming (?), Colorado (S1), Saskatchewan (S?), and possibly North Dakota (SP).

Comments:

ELEMENT DISTRIBUTION

Range: This mesic buffaloberry shrubland community is found in the northern Great Plains of the United States and Canada, extending from Colorado northward to the Dakotas and Saskatchewan. This mesic shrubland community is found in the northern Great Plains on stream terraces, rolling uplands, and badlands.

Nations: CA US

States/Provinces: CO:S1, MT:S3?, ND:S?, SD:S?, SK:S?, WY:S?

ELEMENT SOURCES

Authors: J. Drake, WCS **Confidence:** 2 **Identifier:** CEGL001128

References: Bourgeron and Engelking 1994, DeVelice et al. 1995, Driscoll et al. 1984, Hansen and Hoffman 1988, Hansen et al. 1984, Hansen et al. 1991, Hansen et al. 1995, Jones and Walford 1995, Kittel and Lederer 1993, Kittel et al. 1994, Kittel et al. 1999a, USFS 1992

BETULA NANA SEASONALLY FLOODED SHRUBLAND ALLIANCESwamp Birch Seasonally Flooded Shrubland Alliance

ALLIANCE CONCEPT

Summary: Vegetation types within this seasonally flooded, cold-deciduous alliance occur in marshes in the subalpine and montane riparian zones. Elevations range from 900 m in Montana to 3000 m in Colorado. Communities can occur on beaver ponds, lakes, marshes, seeps, swales, and wet alluvial terraces adjacent to low-gradient meandering streams. They are found in areas where soils are saturated from snowmelt runoff for a significant part of the growing season, often on fens, where the vegetation receives water from seeps and springs. Soils are commonly Histosols, flooded until mid summer and saturated all year in many sites. Quaking mats are typical of many stands. Soil pH in Colorado is 6.3. *Betula nana* (= *Betula glandulosa*) dominates the canopy with 25-60% cover. The canopy is typically dense; however, there are large, open spaces between individual shrub clumps. Other shrubs present include *Salix planifolia*, *Salix monticola*, *Salix wolfii*, and *Dasiphora fruticosa* ssp. *floribunda* (= *Pentaphylloides floribunda*) in the Colorado stands. In the Montana sites *Cornus sericea*, *Alnus incana*, and *Rhamnus alnifolia* can occur. The herbaceous undergrowth is found on small hummocks and is usually dominated by a dense mixture of mesic forbs and mesic graminoids. Mesic graminoids (25-60% cover) include *Calamagrostis canadensis*, *Calamagrostis stricta*, *Carex aquatilis*, *Carex utriculata*, *Carex livida*, and *Deschampsia caespitosa*. Forb cover is sparse and may include *Epilobium ciliatum*, *Caltha leptosepala*, *Ligusticum filicinum*, *Ranunculus sceleratus*, *Sparganium natans* (= *Sparganium minimum*), and *Thalictrum alpinum*. The fern layer can consist of as much as 80% cover with *Equisetum laevigatum*. *Salix planifolia*, *Salix wolfii*, *Salix geyeriana*, and *Dasiphora fruticosa* ssp. *floribunda* shrublands occur in adjacent riparian areas. *Carex* spp., *Deschampsia caespitosa*, and *Eleocharis quinqueflora* meadows may also be present.

Environment: Vegetation types within this alliance occur in marshes in the subalpine and montane riparian zones. Elevations range from 900 m in Montana to 3000 m in Colorado. Communities can occur on beaver ponds, lakes, marshes, seeps, swales, and wet alluvial terraces adjacent to low-gradient meandering streams. They are found in areas where soils are saturated from snowmelt runoff for a significant part of the growing season, often on fens, where the vegetation receives water from seeps and springs.

Soils are commonly Histosols, flooded until midsummer and saturated all year in many sites. Quaking mats are typical of many stands. Komarkova (1986) states that soil pH in Colorado is 6.3.

Salix planifolia, *Salix wolfii*, *Salix geyeriana*, and *Dasiphora fruticosa* ssp. *floribunda* shrublands occur in adjacent riparian areas. *Carex* spp., *Deschampsia caespitosa* and *Eleocharis quinqueflora* meadows are also present.

Vegetation: Vegetation types within this alliance are described as seasonally flooded, cold-deciduous shrublands. *Betula nana* (= *Betula glandulosa*) dominates the canopy with 25-60% cover. The canopy is typically dense, however there are large, open spaces between individual shrub clumps. Other shrubs present include *Salix planifolia*, *Salix monticola*, *Salix wolfii*, and *Dasiphora fruticosa* ssp. *floribunda* (= *Pentaphylloides floribunda*) in the Colorado stands. In the Montana sites *Cornus sericea*, *Alnus incana*, and *Rhamnus alnifolia* can occur. The herbaceous undergrowth is found on small hummocks and is usually dominated by a dense mixture of mesic forbs and mesic graminoids. Mesic graminoids (25-60% cover) include *Calamagrostis canadensis*, *Calamagrostis stricta*, *Carex aquatilis*, *Carex utriculata*, *Carex livida*, and *Deschampsia caespitosa*. Forb cover is sparse and may include *Epilobium ciliatum*, *Caltha leptosepala*, *Ligusticum filicinum*, *Ranunculus sceleratus*, *Sparganium natans* (= *Sparganium minimum*), and *Thalictrum alpinum*. The fern layer can consist of as much as 80% cover with *Equisetum laevigatum*.

Dynamics: This plant association appears to be a long-lived mid- to late-seral community (Viereck et al. 1992 as cited in Kittel et al. 1999). As peatland hummocks develop (become more pronounced), they may become more heavily dominated by *Salix* species (Wendell et al. 1986 as cited in Kittel et al. 1999). Due to cold temperatures and a short growing season, this process may take several decades to occur (Phillips 1977).

ALLIANCE SOURCES

Authors: D. CULVER, West **Identifier:** A.995

References: Hansen et al. 1991, Hansen et al. 1995, Hitchcock et al. 1964, Johnston 1987, Kartesz 1994a, Kettler and McMullen 1996, Kittel et al. 1995, Kittel et al. 1999a, Komarkova 1986, Phillips 1977, Sanderson and Kettler 1996

BETULA OCCIDENTALIS SEASONALLY FLOODED SHRUBLAND ALLIANCEWater Birch Seasonally Flooded Shrubland Alliance

ALLIANCE CONCEPT

Summary: This alliance occurs on stream benches and floodplains in narrow to moderately wide valleys and hillside seeps in the mountains and foothills across much of the western U.S. Surface water is present for extended periods during the growing season. The water table, after flooding ceases, is variable, extending from saturated to well below the ground surface. Substrates are typically alluvial and range from fairly shallow, finer-textured soils to gravel and boulders. Soils usually have signs of saturation (mottles). The vegetation is characterized by a nearly continuous tall-shrub to small-tree canopy dominated by *Betula occidentalis* along the streambank. Other shrub species include *Alnus incana*, *Cornus sericea*, *Dasiphora fruticosa* ssp. *floribunda* (= *Pentaphylloides floribunda*), *Salix exigua*, *Amelanchier utahensis*, *Prunus virginiana*, and *Salix monticola*. Along narrow valleys at higher elevations, conifers may overhang the stream edge. Herbaceous undergrowth is usually limited because of the dense shrub canopy. Forb species include *Maianthemum stellatum*, *Heracleum sphondylium*, *Thalictrum fendleri*, and *Rudbeckia laciniata*. Graminoid cover is usually low and includes the following species: *Carex utriculata*, *Carex pellita* (= *Carex lanuginosa*), *Carex microptera*, *Carex nebrascensis*, *Glyceria* spp., *Juncus balticus*, and introduced hay grasses. Diagnostic of this alliance is the *Betula occidentalis*-dominated tall-shrub layer that occurs on sites that are flooded for extended periods during the growing season.

Environment: Plant associations within this alliance occupy moderately wide stream benches and floodplains in narrow to moderately wide valleys and hillside seeps in the mountains and foothills. At lower elevations along sunny valley bottoms, well-developed, large occurrences occupy relatively flat (1-5% slope) stream benches and often extend away from the channel edge. Elevation ranges from 910 m in Montana to 2700 m in Colorado. Stands also occur along small floodplains of steep-gradient, narrow streams where the valley sideslope meets the stream edge. Other stands occur around seeps adjacent to the stream channel, or along isolated springs on hillslopes away from the valley bottom. Surface water is present for extended periods during the growing season. After flooding ceases, the water table is variable and ranges from nearly saturated to well below the ground surface.

Soils are fairly shallow, ranging from 30 to greater than 60 cm. Most soils have a surface layer of 50-90% organic matter. Subsurface layers are clay loams, sandy clays, and sandy loams. Most profiles have signs of saturation (mottles) at about 10-25 cm depth. Skeletal layers, derived from alluvium, occur at a greater depth. Stands along narrow, steep stream channels occur between large alluvial and colluvial boulders and have almost no soil development.

Adjacent upslope communities include *Pinus edulis* - *Juniperus osteosperma* and *Pinus ponderosa* woodlands on south-facing slopes. *Pseudotsuga menziesii* and mixed *Abies* and *Pinus* forests are present on north-facing slopes in the western United States.

Vegetation: Plant associations within this alliance are classified as seasonally flooded, cold-deciduous shrublands. *Betula occidentalis* forms a nearly continuous tall-shrub to small-tree canopy along the streambank with 15-90% cover. Other shrub species include *Alnus incana*, *Cornus sericea*, *Dasiphora fruticosa* ssp. *floribunda* (= *Pentaphylloides floribunda*), *Salix exigua*, *Jamesia americana*, *Amelanchier utahensis*, *Prunus virginiana*, and *Salix monticola*. Along narrow valleys at higher elevations, conifers may overhang the stream edge. Conifer species present include *Pseudotsuga menziesii*, *Abies lasiocarpa*, and *Picea pungens*. Due to the dense shrub canopy, herbaceous undergrowth is usually limited. Forb species include *Maianthemum stellatum*, *Heracleum sphondylium*, *Thalictrum fendleri*, and *Rudbeckia laciniata*. Graminoid cover is usually low and includes the following species: *Carex utriculata*, *Carex pellita* (= *Carex lanuginosa*), *Carex microptera*, *Carex nebrascensis*, *Glyceria* spp., *Juncus balticus*, and introduced hay grasses.

Dynamics: *Betula occidentalis* is highly adapted to most forms of disturbance. However, heavy grazing may eliminate the more palatable native graminoids, thereby replacing them with introduced species or nonpalatable native species.

ALLIANCE SOURCES

Authors: D. CULVER, West **Identifier:** A.996

References: Crowe and Clausnitzer 1997, Great Plains Flora Association 1986, Hansen et al. 1991, Hansen et al. 1995, Hitchcock et al. 1964, Jones 1992b, Kartesz 1994a, Kearney and Peebles 1969, Kittel and Lederer 1993, Kittel et al. 1994, Kittel et al. 1995, Kittel et al. 1996, Kittel et al. 1999a, Lee and Jonkel 1980, Manning and Padgett 1995, Padgett et al. 1989, Reid et al. 1994, Richard et al. 1996, Sawyer and Keeler-Wolf 1995

BETULA OCCIDENTALIS / MESIC GRAMINOIDS SHRUBLAND Water Birch / Mesic Graminoids Shrubland**ELEMENT CONCEPT**

Summary: This shrubland association often occurs as dense bands up to 35 m wide along moderately wide to wide floodplains in mountain valleys of Colorado and Nevada, and probably Utah. Stands also occur in small patches at higher elevations and around seeps and isolated springs on hillslopes away from the valley bottom. These shrublands are characterized by bands of vegetation, dominated by *Betula occidentalis* (40-60% canopy cover), but often including *Ribes inerme* and *Salix bebbiana*. This vegetation may extend well way from the channel edge in deep pockets of sandy loam soils. *Alnus incana* may be codominant. *Picea pungens* and *Juniperus scopulorum* may also be present, but usually with low cover. Stands with a dense shrub layer may have a limited (<10%), but diverse, herbaceous cover. Graminoids typically dominate the herbaceous layer where the most abundant species usually include *Carex pellita* (= *Carex lanuginosa*), *Carex deweyana*,

or *Carex nebrascensis*. *Deschampsia caespitosa* and *Carex utriculata* are often present as well. Forb cover includes at least 1% cover each of *Achillea millefolium*, *Cardamine cordifolia*, *Heracleum maximum*, *Maianthemum stellatum*, and *Vicia americana*. The introduced grasses *Agrostis stolonifera* and *Poa pratensis* may be present in disturbed stands. Diagnostic of this association is the dominance of *Betula occidentalis* in the shrub layer and the dominance of mesic graminoids in the herbaceous layer.

Similar Associations:

- *Betula occidentalis* / *Maianthemum stellatum* Shrubland (CEGL001162)

GRank & Reasons: G3 (00-12-30). Although the association occurs across a large distributional range, it remains threatened by improper livestock grazing, streamflow alterations, heavy recreational use, and invasion by exotics. Only 10 stands have been documented in Colorado, with 10-20 more estimated to occur. Few high-quality sites exist in Colorado. The number and condition of occurrences in Nevada are unknown, but most low- to moderate-elevation riparian areas have been damaged by the same impacts as those in Colorado.

Comments: This plant association has been documented in Nevada and Colorado. It is likely to occur in Utah, where it may have been classified with other *Betula occidentalis* types. It occurs at slightly lower elevations and on lower-gradient stream reaches than *Alnus incana*. Presence of coniferous trees in the canopy of some stands may indicate that the stand will become a tree-dominated type. It occupies wetter sites than *Betula occidentalis* / *Maianthemum stellatum* Shrubland (CEGL001162).

ELEMENT DISTRIBUTION

Range: This shrubland association often occurs as dense bands up to 35 m wide along moderately wide to wide floodplains in mountain valleys of Colorado and Nevada, and probably Utah.

Nations: US

States/Provinces: CO:S2, NV:S?, UT?

ELEMENT SOURCES

Authors: A.E. Black, WCS **Confidence:** 1 **Identifier:** CEGL002654

References: Kittel and Lederer 1993, Kittel et al. 1994, Kittel et al. 1995, Kittel et al. 1999a, Manning and Padgett 1995, Richard et al. 1996

SALIX BOOTHII SEASONALLY FLOODED SHRUBLAND ALLIANCE Booth's Willow Seasonally Flooded Shrubland Alliance

ALLIANCE CONCEPT

Summary: This widespread alliance occurs throughout much of the western U.S. at elevations from 1320-2800 m. Sites include valley bottoms on swales, banks, and occasionally terraces of stream channels which receive surface water for extended periods of time, especially during the early part of the growing season. Stands adjacent to the stream channel receive moisture from overland and lateral stream flows, and are often associated with beaver ponds. Stands occur on terraces that have a continually high water table. Vegetation in the alliance is also located adjacent to seeps on gently sloping toeslopes, and occasionally in bogs or fens. Soils generally have a deep organic layer with some minerals, fine sands, loams, and clays and gravel or cobbles below. Communities within this shrubland alliance are characterized by a moderately dense to dense *Salix boothii*-dominated tall-shrub layer. Other shrubs may codominate, including *Salix geyeriana*, *Salix planifolia* or *Salix drummondiana*. *Salix wolfii* may occasionally form a relatively sparse, low-shrub layer. Other shrubs may include *Lonicera involucrata*, *Betula nana* (= *Betula glandulosa*), and *Ribes* spp. The moderately dense to dense herbaceous layer is dominated by graminoids and includes *Carex aquatilis*, *Carex utriculata*, *Carex nebrascensis*, *Deschampsia caespitosa*, *Juncus balticus*, and *Trisetum wolfii*. Forb cover is sparse to moderately dense. Common forbs are *Symphyotrichum foliaceum* (= *Aster foliaceus*), *Hedysarum sulphurescens*, *Geum macrophyllum*, *Mertensia ciliata*, *Trollius laxus*, and *Urtica dioica*. Diagnostic of this wetland alliance is a *Salix boothii*-dominated or -codominated tall shrubland that is flooded for extended periods during the growing season.

Environment: Vegetation types in the *Salix boothii* Seasonally Flooded Shrubland Alliance (A.1001) occur in valley bottoms on swales, banks, and occasionally terraces of stream channels which receive surface water for extended periods of time, especially during the early part of the growing season. Stands adjacent to the stream channel receive moisture from overland and lateral stream flows, and are often associated with beaver ponds. Stands occur on terraces which have a continually high water table. Vegetation in the alliance is also located adjacent to seeps on gently sloping toeslopes, and occasionally in bogs or fens. Elevation ranges from 1320-2800 m.

Organic soils develop from the accumulation of fine materials on ponded or previously ponded sites. The upper soil layers generally contain a deep organic layer with some minerals, fine sands, loams, and clays. Some mottling is evident. The lower layers are gravel or cobble. Soils are typically saturated at or near the surface.

Mixed conifer-*Populus tremuloides* and *Populus tremuloides* forests occur on adjacent hillslopes at higher elevations, and *Artemisia tridentata* scrub occurs on adjacent hillsides at lower elevations.

Vegetation: Communities within this alliance are characterized as seasonally flooded cold-deciduous shrublands. The tall-shrub layer is dominated by *Salix boothii*. Several stands are codominated (35-50% cover) by *Salix geyeriana*, *Salix planifolia* or *Salix drummondiana*. *Salix wolfii* may occasionally form a sparse (20-30% cover), low-shrub layer. Other shrubs, *Lonicera involucrata*, *Betula nana* (= *Betula glandulosa*), *Ribes oxyacanthoides* ssp. *setosum* (= *Ribes setosum*), or *Ribes inerme*, may also be present with 10-25% cover. The undergrowth is characterized by a graminoid layer of 40-60% cover and includes *Carex aquatilis*, *Carex utriculata*, *Carex nebrascensis*, *Deschampsia caespitosa*, *Juncus balticus*, and *Trisetum wolfii*. Forb cover is typically 10-25% cover. Forbs include *Symphyotrichum foliaceum* (= *Aster foliaceus*), *Hedysarum sulphurescens*, *Geum macrophyllum*, *Mertensia ciliata*, *Trollius laxus*, and *Urtica dioica*.

Dynamics: Stands within this alliance are dominated by *Salix boothii*, which is often highly productive. Understory production varies, depending on the density of overstory shrubs. Thick shrub stands make access by livestock difficult, therefore this alliance is resistant to grazing effects.

ALLIANCE SOURCES

Authors: D. CULVER, West **Identifier:** A.1001

References: Dorn 1997, Girard et al. 1997, Johnston 1987, Kagan 1997, Kittel and Lederer 1993, Kittel et al. 1994, Kittel et al. 1999a, Kovalchik 1987, Mutz and Graham 1982, Mutz and Queiroz 1983, Norton et al. 1981, Padgett et al. 1988b, Padgett et al. 1989, Sawyer and Keeler-Wolf 1995, Tuhy and Jensen 1982, Youngblood et al. 1985a, Youngblood et al. 1985b

SALIX CANDIDA SEASONALLY FLOODED SHRUBLAND ALLIANCE Hoary Willow Seasonally Flooded Shrubland Alliance

ALLIANCE CONCEPT

Summary: Communities within this uncommon alliance occur in cold bogs, fens, or wet meadows, often where alkaline or marl soils are present. Stands are restricted to anchored organic mats along pond and lake margins. They range in elevation from 1475-2805 m. Soils are characterized by organic horizons greater than 1 m. Water tables normally remain at or near the soil surface throughout the growing season. Communities within this alliance are defined as seasonally flooded cold-deciduous shrublands. They are dominated by *Salix candida*, a short shrub that can reach heights of 3 m, but usually is less than 1 m. The short-shrub layer is characterized by scattered clumps of *Salix candida* over a dense (25-60%) stand of *Carex utriculata*, *Carex simulata*, *Schoenoplectus acutus* (= *Scirpus acutus*), and *Carex aquatilis*. The forb layer is sparse and consists of *Triglochin maritima*, *Menyanthes trifoliata*, and *Polygonum amphibium*. Adjacent upslope communities are typically *Dasiphora fruticosa* ssp. *floribunda* (= *Pentaphylloides floribunda*) with *Deschampsia caespitosa*.

Environment: Communities within this uncommon alliance occur in cold bogs, fens, or wet meadows, often where alkaline or marl soils are present. Stands are restricted to anchored organic mats along pond and lake margins. They range in elevation from 1475-2805 m.

Soils are characterized by organic horizons greater than 1 m. Water tables normally remain at or near the soil surface throughout the growing season.

Adjacent upslope communities are typically *Dasiphora fruticosa* ssp. *floribunda* with *Deschampsia caespitosa*.

Vegetation: Communities within this alliance are defined as seasonally flooded cold-deciduous shrublands. They are dominated by *Salix candida* that is generally a short shrub that can reach heights of 3 m, but usually is less than 1 m. The short-shrub layer is characterized by scattered clumps of *Salix candida* over a dense (25-60%) stand of *Carex utriculata*, *Carex simulata*, *Schoenoplectus acutus* (= *Scirpus acutus*), and *Carex aquatilis*. The forb layer is sparse and consists of *Triglochin maritima*, *Menyanthes trifoliata*, and *Polygonum amphibium*.

Dynamics: *Salix candida*, with persistent heavy browsing, is likely to be all but eliminated from stands of this alliance, leading to the dominance of *Carex utriculata* (Hansen et al. 1995).

ALLIANCE SOURCES

Authors: D. CULVER, West **Identifier:** A.1002

References: Dorn 1997, Hansen et al. 1991, Hansen et al. 1995, Hitchcock et al. 1964, Steele et al. 1981

SALIX CANDIDA / CAREX UTRICULATA SHRUBLAND Hoary Willow / Beaked Sedge Shrubland

ELEMENT CONCEPT

Summary: This is a rare association that occurs between 1476 to 2348 m (4840-7700 feet) elevation in mountains and basins of western Montana, as well as at scattered localities in eastern Idaho, the Black Hills of South Dakota, and northwestern Wyoming. This association is restricted to continuously wet, anaerobic histosolic soils of peatlands. Stands often form on anchored floating mats along montane lake margins and sometimes occur in spring-fed rich-fens in intermountain basins. The association is characterized by widely scattered clumps of 1- to 1.5-m tall *Salix candida*, with lesser amounts of other low *Salix* species (e.g., *Salix planifolia*, *Salix exigua*, *Salix bebbiana*, *Salix serissima*, or *Salix wolfii*), *Betula nana*, and/or *Dasiphora fruticosa* ssp. *floribunda*. The open shrub layer (up to 30% cover) occurs within a sward of

Carex utriculata, often mixed with *Carex aquatilis*, which sometimes includes other graminoid species such as *Carex simulata*, *Carex nebrascensis*, *Deschampsia caespitosa*, *Calamagrostis canadensis*, *Glyceria striata*, and *Juncus balticus*. Total forb cover is generally low to moderate, mostly composed of *Gentianopsis thermalis*, *Menyanthes trifoliata*, *Packera streptanthifolia*, *Symphyotrichum foliaceum*, *Triglochin maritima*, and various rare and/or endemic fen species.

Environment: This association is restricted to continuously wet, anaerobic histosolic soils of peatlands. Sites with these soils, such as anchored floating mats along montane lake margins and in rich-fens, are naturally rare across the landscape and difficult to restore when disturbed (Jankovsky-Jones 1999). In the Black Hills, the single stand at McIntosh Fen is on the eastern edge of the Limestone Plateau at 6000 feet elevation. It occurs in a broad drainage bottom underlain by metamorphic rocks and traversed by Castle Creek. Water issuing from springs in the limestone strata on the sides of the drainage contribute to the alkalinity of the wetland (Marriott and Faber-Langendoen 2000).

Vegetation: Overall shrub cover is in the 25-60% range. Herbaceous cover is 60-100%. Stands consist of small patches of *Salix candida*, *Salix serissima*, *Salix exigua*, *Salix bebbiana*, and *Dasiphora fruticosa* ssp. *floribunda* (= *Pentaphylloides floribunda*). Any of these shrubs may be locally dominant. Common herbaceous species include *Carex rostrata*, *Carex nebrascensis*, *Juncus balticus*, *Calamagrostis canadensis*, and wetland forbs (Marriott and Faber-Langendoen 2000).

Dynamics: With persistent heavy browsing, sage willow is likely to be eliminated from stands of this type, leading to dominance by beaked sedge and other wetland graminoids (Hansen et al. 1995). The impact on other willows probably would be similar. In contrast, shrubby-cinquefoil often increases with heavy utilization.

GRank & Reasons: G2 (02-10-22). This is a rare association restricted to wet, histosolic soils of peatlands in mountains and basins of the Northern Rockies in Montana, Wyoming, and Idaho, and also occurs in the Black Hills. Sites with the potential to support this association, such as floating mats along montane lake margins and spring-fed rich-fens, are naturally rare and small in area across this range. While distinct stands have been sampled, this association is somewhat broadly defined and, at times, heterogeneous and ill defined. The actual number of occurrences clearly dominated by *Salix candida* and *Carex utriculata* is estimated to be less than 20. Although common threats to fens, including cattle grazing and damage to organic soils, ditching and draining, water diversion and groundwater pumping, and road building, have not been documented in areas supporting this association, alteration of the hydrologic regime required for supporting this fen association would likely lead to its elimination. Because of the low number of occurrences and its high habitat specificity, this association is best ranked as G2 rather than G3.

Comments: This association has been quantitatively described from 24 stands in Montana (Hansen et al. 1995) and 1 stand in Wyoming (Walford et al. 2001). The association is loosely defined, and some stands classified by Hansen et al. (1995) as this type were dominated by *Betula nana* or *Salix glauca*, or had understories dominated by *Carex aquatilis*, *Carex simulata*, or *Juncus balticus* (MTNHP 2002). *Salix candida* / *Carex lasiocarpa* and *Salix candida* / *Juncus balticus* stands have also been sampled in Montana (MTNHP 2002). *Salix candida* is known from only 16 sites in Idaho, but at only two sites is it a common shrub species within *Carex utriculata* meadow. Nevertheless, stands clearly characterized by *Salix candida* and *Carex utriculata* dominance have been sampled from throughout the range of the association in Montana and Wyoming.

ELEMENT DISTRIBUTION

Range: This is a rare association restricted to wet, histosolic soils of peatlands in mountains and basins of the Northern Rockies in Montana, Wyoming, and Idaho, and also occurs in the Black Hills of South Dakota. Because *Salix candida* is a widespread boreal species, stands of this association are expected to occur in adjacent Canada, but they have not yet been reported.

Nations: CA? US

States/Provinces: BC?, ID:S1, MT:S2, SD:S?, WY:SU

ELEMENT SOURCES

Authors: P.K. Hansen, K. Boggs, and R. Pfister, mod. H. Marriott and D. Faber-Langendoen, WCS **Confidence:** 2

Identifier: CEGL001188

References: Bourgeron and Engelking 1994, Driscoll et al. 1984, Hansen et al. 1991, Hansen et al. 1995, IDCDC 2002, Jankovsky-Jones 1996, Jankovsky-Jones 1999, MTNHP 2002, Marriott and Faber-Langendoen 2000, McIntosh 1930, Steele et al. 1981, Walford et al. 2001

SALIX DRUMMONDIANA SEASONALLY FLOODED SHRUBLAND ALLIANCE Drummond's Willow Seasonally Flooded Shrubland Alliance

ALLIANCE CONCEPT

Summary: Communities within the *Salix drummondiana* Seasonally Flooded Shrubland Alliance (A.1004) occur on alluvial terraces adjacent to mountain rivers and streams. Occurrences occupy gentle undulating surfaces with slopes ranging from 5-30%. They range in elevation from 2135-3300 m. These communities are often associated with beaver activity. They are typically located adjacent to beaver ponds, lakes, seeps and springs, and on alluvial terraces adjacent to mountain rivers and streams. Soils are usually peaty with organic matter accumulation. Soil textures range from silt to clay loam. Water tables are

usually at or near the surface. Gleyed soil is common at any depth. Soil texture is fine-loamy, loamy-skeletal, and sandy. The soils classify as Cryaquolls and Cryaquepts. Vegetation types within this alliance are classified as seasonally flooded, cold-deciduous shrublands. *Salix drummondiana* dominates the tall-shrub layer with open, corridor-like canopies with a dense graminoid layer in the understory. *Salix monticola*, *Salix planifolia*, and *Dasiphora fruticosa* ssp. *floribunda* (= *Pentaphylloides floribunda*) are often present in the shrub layer. The graminoid layer is typically dominated by *Carex utriculata* with cover of 50-75%. Forb cover is relatively low. Species can include *Geum macrophyllum* and *Epilobium ciliatum* with 1-10% cover. *Pinus contorta* and *Populus tremuloides* forests occur on adjacent hillslopes.

Environment: Communities within the *Salix drummondiana* Seasonally Flooded Shrubland Alliance (A.1004) occur on alluvial terraces adjacent to mountain rivers and streams. Occurrences occupy gentle undulating surfaces with slopes ranging from 5-30%. They range in elevation from 2135-3300 m. These communities are often associated with beaver activity. They are typically located adjacent to beaver ponds, lakes, seeps and springs, and on alluvial terraces adjacent to mountain rivers and streams.

Soils are usually peaty with organic matter accumulation. Soil textures range from silt to clay loam. Water tables are usually at or near the surface. Gleyed soil is common at any depth. Soil texture is fine-loamy, loamy-skeletal, and sandy. According to Johnston (1987), the soils classify as Cryaquolls and Cryaquepts.

Pinus contorta and *Populus tremuloides* forests occur on adjacent hillslopes.

Vegetation: Vegetation types within this alliance are classified as seasonally flooded, cold-deciduous shrublands. *Salix drummondiana* dominates the tall-shrub layer with open, corridor-like canopies with a dense graminoid layer in the understory. *Salix monticola*, *Salix planifolia*, and *Dasiphora fruticosa* ssp. *floribunda* (= *Pentaphylloides floribunda*) are often present in the shrub layer. The graminoid layer is typically dominated by *Carex utriculata* with a percent cover of 50-75%. Forb cover is relatively low. Species can include *Geum macrophyllum* and *Epilobium ciliatum* with 1-10% cover.

Dynamics: The areal abundance of the plant association within this alliance appears to be limited to saturated wetland environments and therefore may be dependent on beaver populations that maintain a high water table. In addition, near beaver activity, this association may be a mid-successional community that will eventually become a *Salix planifolia*- or *Salix monticola*-dominated type as the area dries slightly and becomes filled in by sedimentation (Sanderson and Kettler 1996).

ALLIANCE SOURCES

Authors: D. CULVER, West **Identifier:** A.1004

References: Baker 1989b, Hansen et al. 1995, Hickman 1993, Hitchcock et al. 1964, Johnston 1987, Kittel and Lederer 1993, Kittel et al. 1999a, Komarkova 1986, Kovalchik 1993, Manning and Padgett 1995, Moseley et al. 1994, Mutz and Queiroz 1983, Sanderson and Kettler 1996

SALIX DRUMMONDIANA / CAREX UTRICULATA SHRUBLAND Drummond's Willow / Beaked Sedge Shrubland

ELEMENT CONCEPT

Summary: This is a broadly distributed association ranging from eastern Washington west into Montana. In Montana it has an elevational range spanning over 1525 m (5000 feet) from 700-2380 m (2300-7800 feet). Its primary habitat is adjacent to beaver ponds, mountain rivers and streams, alluvial terraces and marshes as well as seeps and springs. In southern Montana the *Salix drummondiana*-dominated types occupy higher elevation sites with *Salix geyeriana*- and *Salix boothii*-dominated types tending to occur at intermediate elevations, though this is not necessarily the distribution pattern in other areas. *Salix drummondiana* is 100% constant, its cover averaging over 50% and no other shrubs are even 50% constant or have more than 30% cover. At least in a major part of its range 10% canopy cover of any one of five *Carex* spp. (*Carex utriculata*, *Carex vesicaria*, *Carex atherodes*, *Carex aquatilis*, *Carex lenticularis*) or any combination of these five is diagnostic for the type; in the most general case *Carex utriculata* must dominate the herbaceous component. Modal stands tend to have *Carex utriculata* dominant or codominant with *Carex aquatilis*. A whole host of introduced graminoids proliferate with grazing disturbance. The forb component is generally insignificant, only occasionally comprising more than 10% cover. *Canadanthus modestus* (= *Aster modestus*), *Symphyotrichum spathulatum* var. *spathulatum* (= *Aster occidentalis*), *Geum macrophyllum*, *Epilobium ciliatum*, *Comarum palustre* (= *Potentilla palustris*), and *Mentha arvensis* are the forbs having both the highest constancy and coverage values.

Similar Associations:

- *Salix boothii* / *Carex utriculata* Shrubland (CEGL001178)
- *Salix geyeriana* / *Carex utriculata* Shrubland (CEGL001207)
- *Salix lutea* / *Carex utriculata* Shrubland (CEGL001220)
- *Salix candida* / *Carex utriculata* Shrubland (CEGL001188)
- *Salix wolfii* / *Carex utriculata* Shrubland (CEGL001237)

GRank & Reasons: G4 (00-01-29). This association (or the environments it represents) is very common, perhaps one of the most common, *Salix* spp.-dominated riparian/wetland types of the Northwest and Intermountain West. Even were it to be most narrowly defined, say by the dominance of *Salix drummondiana* and *Carex utriculata* alone (other species a minor

component) or by these species having very high cover values, say in excess of 50%, then this type would still be abundant. The most significant threat to this community is livestock overuse, which can lead to the reduced vigor, highlining, clubbing, or death of willows. The principal graminoids, *Carex utriculata* and *Carex aquatilis*, are not particularly palatable, but on narrow riparian or small wetland sites within extensive rangeland, these and other sedge species are heavily utilized, particularly where stocking rates are high. Vegetation trampling, hummocking and a shift to weedy species (or their introduction) occurs as a result and can result in an irremediable type conversion.

Comments: This type is substantiated by 43 plots in Montana and 20 plots in Washington. In addition, surrounding states have a number of well-documented, highly similar tall *Salix* spp.-dominated associations in which *Salix drummondiana* can be both a dominant/codominant and highly constant, including *Salix drummondiana* - *Salix boothii* / *Carex rostrata* - *Carex aquatilis* Shrubland (not in USNVC), *Salix boothii* / *Carex utriculata* Shrubland (CEGL001178), *Salix geyeriana* / *Carex utriculata* Shrubland (CEGL001207), and *Salix lutea* / *Carex utriculata* Shrubland (CEGL001220). *Salix drummondiana* can also be a major component in short willow communities, e.g., *Salix candida* / *Carex utriculata* Shrubland (CEGL001188) and *Salix wolfii* / *Carex utriculata* Shrubland (CEGL001237). Other *Salix* spp.-dominated associations have appreciable coverages of *Carex utriculata*, raising the issue of what coverages of *Carex utriculata* will be accorded indicator status. Another significant hurdle in establishing confidence in this type is what, if any, *Carex* spp. will be accepted as ecological equivalents (as used by Hansen et al. 1995). In addition *Salix drummondiana* is easily confused with *Salix sitchensis* making community identification difficult. There is a monumental amount of crosswalk work to accomplish before this type can be unequivocally classified across its considerable geographic range. Similar, if not identical, types under different names have been described throughout the Northwest and Intermountain West. However, a type of this exact name (accepting *Carex utriculata* as synonymous with *Carex rostrata*) was first described for Montana; its identifying series or alliance level features are *Salix* spp. having at least 10% canopy cover and *Salix drummondiana* having greater canopy cover than the combined cover of *Salix geyeriana* and *Salix boothii* and less cover than *Salix lutea*.

ELEMENT DISTRIBUTION

Range: This association is found abundantly in the Northern Rocky Mountains of Montana and Idaho, and in eastern Washington. It may also occur in northern Utah and western Wyoming, but has not been confirmed from these states.

Nations: CA? US

States/Provinces: BC?, ID:S3, MT:S4, UT?, WA:S3, WY?

ELEMENT SOURCES

Authors: S.V. Cooper, WCS **Confidence:** 2 **Identifier:** CEGL002631

References: Bourgeron and Engelking 1994, Driscoll et al. 1984, Hall and Hansen 1997, Hansen et al. 1995, Kovalchik 1993, Moseley et al. 1994

SALIX GEYERIANA SEASONALLY FLOODED SHRUBLAND ALLIANCE Geyer's Willow Seasonally Flooded Shrubland Alliance

ALLIANCE CONCEPT

Summary: Communities within this temporarily flooded, cold-deciduous shrubland alliance occur from the foothills to high elevations in the mountains of the western United States. Elevation ranges from 1320-2900 m. Landforms include broad benches and alluvial terraces of streams, springs, and seeps. Stands often develop on abandoned and sediment-filled beaver ponds. Soils are composed of deep, fine-textured alluvium over subsurface soils of various textures and origin. Surface textures are silt to silty clay loam with mottling near the surface. Soils have a high water-holding capacity. Organic matter may accumulate on the surface. The communities are characterized by a tall-shrub layer dominated by *Salix geyeriana*. Occasional codominants include *Salix monticola*, *Salix boothii*, *Salix lemmonii*, or *Salix eriocephala*. Some stands have shorter willows in the understory, including *Salix wolfii* and *Salix planifolia*. Other shrub species include *Lonicera utahensis*, *Dasiphora fruticosa* ssp. *floribunda* (= *Pentaphylloides fruticosa*), and *Ribes* spp. *Calamagrostis canadensis*, *Calamagrostis stricta*, *Poa palustris*, *Deschampsia caespitosa*, *Carex aquatilis*, and *Carex utriculata* are the dominant graminoid species with 10-60% cover. The forb layer is minor with 10-20% cover and includes *Geum macrophyllum*, *Pyrola asarifolia*, *Galium trifidum*, and *Epilobium ciliatum*. *Populus tremuloides*, *Pinus contorta*, and *Pinus ponderosa* forests occur on surrounding hillslopes.

Environment: Communities within this alliance occur from the foothills to high elevations in the mountains of the western United States. Elevation ranges from 1320-2900 m. Landforms include broad benches and alluvial terraces of streams, springs, and seeps. Stands often develop on abandoned and sediment-filled beaver ponds. Soils are composed of deep, fine-textured alluvium over subsurface soils of various textures and origin. Surface textures are silt to silty clay loam with mottling near the surface. Soils have a high water-holding capacity. Organic matter may accumulate on the surface.

Populus tremuloides, *Pinus contorta*, and *Pinus ponderosa* forests occur on surrounding hillslopes.

Vegetation: Communities within this alliance are classified as temporarily flooded cold-deciduous shrublands. The communities are characterized by a tall-shrub layer dominated by *Salix geyeriana*. Occasional codominants include *Salix*

monticola, *Salix boothii*, *Salix lemmonii* or *Salix eriocephala*. Some stands have shorter willows in the understory, including *Salix wolfii* and *Salix planifolia*. Other shrub species include *Lonicera utahensis*, *Dasiphora fruticosa* ssp. *floribunda* (= *Pentaphylloides fruticosa*), and *Ribes* spp. *Calamagrostis canadensis*, *Calamagrostis stricta*, *Poa palustris*, *Deschampsia caespitosa*, *Carex aquatilis*, and *Carex utriculata* are the dominant graminoid species with 10-60% cover. The forb layer is minor with 10-20% cover and includes *Geum macrophyllum*, *Pyrola asarifolia*, *Galium trifidum*, and *Epilobium ciliatum*. **Dynamics:** Characteristics of the herbaceous layer and soils suggest that many of the vegetation types within this alliance are stable (Youngblood et al. 1985b). However, livestock grazing pressure will cause a decrease in the native graminoids (Hansen et al. 1995).

ALLIANCE SOURCES

Authors: D. CULVER, West **Identifier:** A.1006

References: Baker 1989b, Cooper and Cottrell 1990, Hansen et al. 1991, Hansen et al. 1995, Jensen and Tuhy 1981, Johnston 1987, Jones 1992b, Kagan 1997, Kearney and Peebles 1969, Kettler and McMullen 1996, Kittel and Lederer 1993, Kittel et al. 1994, Kittel et al. 1995, Kittel et al. 1996, Kittel et al. 1999a, Kovalchik 1987, Mutz and Queiroz 1983, Padgett and Manning 1988, Padgett et al. 1988b, Padgett et al. 1989, Tuhy and Jensen 1982, Youngblood et al. 1985a, Youngblood et al. 1985b

SALIX GEYERIANA / CAREX UTRICULATA SHRUBLAND Geyer's Willow / Beaked Sedge Shrubland

ELEMENT CONCEPT

Summary: In Colorado, this riparian shrubland occurs often on wet soils, that are saturated throughout much of the growing season. Stands have a 1.5- to 2.5-m tall, nearly closed canopy that is dominated by the deciduous shrub *Salix geyeriana* with a thick carpet of graminoids in the undergrowth that is dominated by *Carex utriculata*. Information on stands that occur outside Colorado will be added later.

ELEMENT DISTRIBUTION

Range:

Nations: US

States/Provinces: CO:S3, ID:S4, MT:S5, NV:SR, OR:S2, UT:S2S3, WY:SR

TNC Ecoregions: 10:C, 20:C, 6:C

ELEMENT SOURCES

Authors: WCS **Confidence:** 1 **Identifier:** CEGL001207

References: Bourgeron and Engelking 1994, Driscoll et al. 1984, Hansen et al. 1991, Hansen et al. 1995, Kettler and McMullen 1996, Kittel and Lederer 1993, Kittel et al. 1999a, Mutz and Queiroz 1983, Padgett et al. 1989, Tuhy and Jensen 1982, Youngblood et al. 1985a

SALIX WOLFII SEASONALLY FLOODED SHRUBLAND ALLIANCE Wolf Willow Seasonally Flooded Shrubland Alliance

ALLIANCE CONCEPT

Summary: Communities within this cold-deciduous shrubland alliance occur in moderately narrow to wide valleys and glacial basins in saturated peat wetlands and on floodplains with lateral seepage of groundwater. Valley slopes range from 3-7%, and stream channels that run through the valleys vary from deep, narrow, and sinuous to shallow, broad, and gently meandering. Beavers are often active within the stands. Some stands occur on seeps, which remain wet throughout the growing season. Elevation ranges from 1950-3350 m. Soils vary from highly organic or peat to mineral based. Soil textures include silty clay loams, silty loams, and sandy clay loams with mottling. Some stands occur on deep sandy clays, often with a high organic content, while other stands occur on shallow silty clays over gravels and rocks. The shrub layer is typically dominated by at least 70% cover of *Salix wolfii*. Other willow species may include *Salix planifolia*, *Salix boothii*, *Salix monticola*, and *Salix brachycarpa*. *Betula nana* (= *Betula glandulosa*) also occurs on wetter sites. The graminoid undergrowth is generally dense and rich, dominated by *Carex aquatilis*, *Carex utriculata*, *Deschampsia caespitosa*, *Carex nebrascensis*, and *Carex microptera*. Forb cover varies from sparse (<10%) to moderately dense (60%) and is generally diverse. Forb species include *Caltha leptosepala*, *Ligusticum tenuifolium*, *Swertia perennis*, *Pedicularis groenlandica*, and *Thalictrum alpinum*. At higher elevations, adjacent hillsides are often covered with *Abies lasiocarpa* - *Picea engelmannii* or *Pinus contorta* forests, *Festuca thurberi* subalpine meadows, or alpine tundra. At lower elevations, *Artemisia tridentata* scrub is often present on adjacent hillslopes.

Environment: Communities within this alliance occur in moderately narrow to wide valleys and glacial basins in saturated peat wetlands and on floodplains with lateral seepage of groundwater. Valley slopes range from 3-7%, and stream channels that run through the valleys vary from deep, narrow, and sinuous to shallow, broad, and gently meandering. Beavers are often

active within the stands. Some stands occur on seeps, which remain wet throughout the growing season. Elevation ranges from 1950-3350 m.

Soils vary from highly organic or peat to mineral based. Soil textures include silty clay loams, silty loams, and sandy clay loams with mottling. Some stands occur on deep sandy clays, often with a high organic content, while other stands occur on shallow silty clays over gravels and rocks.

At higher elevations, adjacent hillsides are often covered with *Abies lasiocarpa* - *Picea engelmannii* or *Pinus contorta* forests, *Festuca thurberi* subalpine meadows, or alpine tundra. At lower elevations, *Artemisia tridentata* scrub is often present on adjacent hillslopes.

Vegetation: Communities within this alliance are defined as cold-deciduous shrublands. The shrub layer is typically dominated by at least 70% cover of *Salix wolfii*. Other willow species may include *Salix planifolia*, *Salix boothii*, *Salix monticola*, and *Salix brachycarpa*. *Betula nana* (= *Betula glandulosa*) also occurs on wetter sites. The graminoid undergrowth is generally dense and rich, dominated by *Carex aquatilis*, *Carex utriculata*, *Deschampsia caespitosa*, *Carex nebrascensis*, and *Carex microptera*. Forb cover varies from sparse (<10%) to moderately dense (60%) and is generally diverse. Forb species include *Caltha leptosepala*, *Ligusticum tenuifolium*, *Swertia perennis*, *Pedicularis groenlandica*, and *Thalictrum alpinum*.

Dynamics: In Colorado, *Salix wolfii* grows on deep, undecomposed peat, while *Salix planifolia* tends to grow on more decomposed (humified) organic soils (Phillips 1977). In Montana, *Salix planifolia* stands are observed on wetter and more fine-textured soils than sites containing *Salix wolfii* communities (Hansen et al. 1988).

ALLIANCE SOURCES

Authors: D. CULVER, West **Identifier:** A.1009

References: Baker 1986, Baker 1989b, Girard et al. 1997, Hansen et al. 1991, Hansen et al. 1995, Hitchcock et al. 1964, Jensen and Tuhy 1981, Johnston 1987, Jones 1992b, Kettler and McMullen 1996, Kittel and Lederer 1993, Kittel et al. 1994, Kittel et al. 1995, Kittel et al. 1996, Kittel et al. 1999a, Mattson 1984, Mutz and Graham 1982, Norton et al. 1981, Padgett et al. 1988b, Padgett et al. 1989, Phillips 1977, Tuhy 1981, Tuhy and Jensen 1982, Youngblood et al. 1985a, Youngblood et al. 1985b

SARCOBATUS VERMICULATUS INTERMITTENTLY FLOODED SHRUBLAND

ALLIANCE Black Greasewood Intermittently Flooded Shrubland Alliance

ALLIANCE CONCEPT

Summary: This widespread shrubland alliance occurs on lowland sites in plains, mountain valleys and intermountain basins throughout the arid and semi-arid western United States. Sites are generally flat, poorly drained and intermittently flooded with a shallow or perched water table often within 1 m depth such as alkali flats around playas and floodplains along stream channels. Substrates are generally shallow, calcareous, fine-textured soils derived from alluvium. Soils are alkaline and typically moderately saline. Shrublands included in this alliance are dominated or codominated by *Sarcobatus vermiculatus*. Other shrubby codominants include *Picrothamnus desertorum* (= *Artemisia spinescens*), *Artemisia tridentata*, *Atriplex confertifolia*, *Atriplex gardneri*, *Chrysothamnus* spp., or *Grayia spinosa*. In more saline environments, *Nitrophila occidentalis* and *Suaeda moquinii* may be present. If present, the sparse to moderate herbaceous layer is dominated by perennial grasses, such as *Distichlis spicata* and *Pascopyrum smithii*, or the perennial bunch grasses *Elymus elymoides*, *Hordeum jubatum*, *Leymus cinereus*, and *Achnatherum hymenoides* (= *Oryzopsis hymenoides*) will dominate. Perennial forbs are typically sparse and often include *Grindelia squarrosa*, *Iva axillaris*, and *Sphaeralcea coccinea*. Annual grasses, especially the exotic *Bromus* spp., may be present to abundant. Forbs are common on disturbed sites. Weedy annual forbs may include the exotics *Descurainia* spp., *Helianthus annuus*, *Halogeton glomeratus*, *Lactuca serriola*, and *Lepidium perfoliatum*. Diagnostic of this alliance is the *Sarcobatus vermiculatus*-dominated shrub layer in a shrubland that has a relatively shallow water table and may be flooded intermittently during the growing season.

Environment: Shrublands included in this alliance occur on lowland sites in plains, mountain valleys and intermountain basins throughout the arid and semi-arid western United States. Elevations range from 100-2400 m. Summers are hot. Winters are generally cold, but are mild in subtropical regions. Precipitation varies with geography but is generally low and infrequent. Sites are generally flat, poorly drained and intermittently flooded with a shallow or perched water table often within 1 m depth (West 1983b). Substrates are generally shallow, calcareous, fine-textured soils (clays to silt-loams), derived from alluvium. Soils are alkaline and typically moderately saline (West 1983b).

Adjacent upland vegetation depends on geography. In the Great Plains, it is likely shortgrass or midgrass prairie. In the Great Basin and central Wyoming, upland vegetation is typically *Artemisia* spp.- or *Grayia spinosa*-dominated shrublands. In the Mojave and other warm desert sites, *Larrea tridentata*, *Grayia spinosa*, or *Atriplex* spp. dominate the upland sites. In the California Central Valley adjacent upland vegetation is dominated by *Atriplex* spp. with annual grasses. Lowland vegetation is typically sparser stands of *Sarcobatus vermiculatus* or stands of species more tolerant of saline soils or poor soil aeration such as *Distichlis spicata*, *Allenrolfea occidentalis* or *Suaeda moquinii* (Franklin and Dyrness 1973, Young et al. 1986).

Vegetation: This widespread alliance includes shrublands from alkali flats around playas and floodplains along stream channels that dissect much of the arid and semi-arid western U.S. Stands have a moderately dense to dense woody layer (20-60% cover) dominated or codominated by the deciduous, facultative halophytic shrub *Sarcobatus vermiculatus*. Other shrubby codominants include *Picrothamnus desertorum* (= *Artemisia spinescens*), *Artemisia tridentata*, *Atriplex confertifolia*, *Atriplex gardneri*, *Chrysothamnus* spp. or *Grayia spinosa*. In more saline environments, *Nitrophila occidentalis* and *Suaeda moquinii* may be present. Herbaceous layers range from absent to a moderately dense canopy of medium-tall to short bunch grasses or sod grasses (0-25% cover). If the herbaceous layer is present, perennial grasses such as the strongly rhizomatous *Distichlis spicata* and *Pascopyrum smithii*, or the perennial bunch grasses *Elymus elymoides*, *Hordeum jubatum*, *Leymus cinereus*, and *Achnatherum hymenoides* (= *Oryzopsis hymenoides*) will dominate. Perennial forbs are typically sparse and often include *Grindelia squarrosa*, *Iva axillaris*, and *Sphaeralcea coccinea*. Annual grasses, especially the exotic *Bromus japonicus*, *Bromus rubens*, and *Bromus tectorum*, may be present to abundant. Forbs are common on disturbed weedy sites. Weedy annual forbs may include the exotics *Descurainia* spp., *Helianthus annuus*, *Halogeton glomeratus*, *Lactuca serriola*, and *Lepidium perfoliatum*.

Dynamics: *Sarcobatus vermiculatus*, like many facultative halophytes, is tolerant of alkaline and saline soil conditions that allow the species to occur in sites with less interspecific competition (Ungar et al. 1969, Branson et al. 1976). The shrub also occurs on extremely arid non-saline sites. *Sarcobatus vermiculatus* is often found on sites with high water tables that are intermittently flooded. Hansen et al. (1995) reported that it can tolerate saturated soil conditions for up to 40 days. *Sarcobatus vermiculatus*-dominated vegetation can occur as a narrow band along a channel, or in a mosaic of communities where composition and density of the shrub and understory species vary with depth to water table, salinity and alkalinity, soil texture, and past land use or disturbance. Hanson (1929) described stands in south-central Colorado and found that pure stands of *Sarcobatus vermiculatus* and *Distichlis spicata* are more common on strongly saline/alkaline sites with fine-textured soil and shallow water tables, whereas stands with mixed shrubs such as *Chrysothamnus* or *Artemisia* are more common on drier, coarser textured, low-alkaline sites. *Sporobolus airoides* is found on dry, strongly alkaline sites, and *Pascopyrum smithii* is most common on less alkaline, moist, sites in low lying areas.

Sarcobatus vermiculatus is not ordinarily browsed, but Daubenmire (1970) found that under heavy stocking rates, the shrubs will develop a compact canopy. Hansen et al. (1995) also reported browsing damage with heavy spring and summer grazing, but noted that *Sarcobatus vermiculatus* is moderately poisonous to livestock especially in the fall, and supplemental feed is recommended to avoid livestock loss. Hanson (1929) states that *Sarcobatus vermiculatus* can form an important part of winter forage for sheep. Fire will topkill *Sarcobatus vermiculatus*, but the shrub will promptly resprout from the root crown (Daubenmire 1970).

NRCS range sites for the eastern plains of Colorado do not describe this alliance on good condition sites. Several range sites (Salt flat #33, Saline overflow #37) list *Sarcobatus vermiculatus* as present in low abundance in good condition stands but describe it as increasing with overgrazing. The NRCS range sites also describe *Bouteloua gracilis* increasing with overgrazing. Stands dominated by *Sarcobatus vermiculatus* with an understory dominated by *Bouteloua gracilis* been observed in eastern Colorado (S. Kettler pers. obs.).

Comments: Most *Sarcobatus vermiculatus* stands are classified into alliances by flood regime or shrub canopy density. The mixed-shrub stands in non-*Sarcobatus* alliances may be more difficult to classify.

Sarcobatus vermiculatus / *Atriplex gardneri* Shrubland (CEGL001360) is currently grouped in this intermittently flooded alliance. According to DeVelice and Lesica (1993) and DeVelice et al. (1995), the *Sarcobatus vermiculatus* - *Atriplex gardneri* community type is restricted to moderate to steep slopes of 'badlands' characterized by acid shale, bentonite or other highly erodible clayey substrate. These shrublands may be located near seeps and have seasonally saturated soils, but are not intermittently flooded and may be more appropriately classified in the III.B.3.N.a *Sarcobatus vermiculatus* Shrubland Alliance (A.1041).

ALLIANCE SOURCES

Authors: K. SCHULZ, JT, West **Identifier:** A.1046

References: Barbour and Major 1977, Blackburn et al. 1969b, Blackburn et al. 1969c, Blackburn et al. 1969d, Blackburn et al. 1971, Branson and Owen 1970, Branson et al. 1976, Brotherson et al. 1986, Brown 1982, Bundy et al. 1996, Chappell et al. 1997, Copeland 1979, Copeland and Greene 1982, Dastrup 1963, Daubenmire 1970, DeVelice and Lesica 1993, DeVelice et al. 1991, DeVelice et al. 1995, Dick-Peddie 1993, Fenimore 1970, Francis 1986, Franklin and Dyrness 1973, Graham 1937, Hamner 1964, Hansen et al. 1995, Hanson 1929, Holland 1986b, Johnston 1987, Lesica and DeVelice 1992, Medicine Bow Mine Application n.d., Mueggler and Stewart 1980, Sawyer and Keeler-Wolf 1995, Sweetwater Uranium Project 1978, Terwilliger and Smith 1978, Tweit and Houston 1980, Ungar et al. 1969, West 1983b, Young et al. 1986

SARCOBATUS VERMICULATUS / DISTICHLIS SPICATA SHRUBLAND Black Greasewood / Saltgrass Shrubland

ELEMENT CONCEPT

Summary: This association is reported from western Montana to Washington, south to Nevada, Utah and Colorado. Elevation ranges from approximately 600-2300 m. It forms expansive shrublands on broad floodplains along large rivers and

streams, and forms an outer ring around playas above the *Distichlis spicata*-dominated center. Flooding is generally intermittent. Substrates are deep, alkaline, saline and generally fine-textured soils with a perennial high water table. However, in southern Colorado's San Luis valley, stands grow between salt flat depressions (playas) on sandy hummocks approximately 1.2 m above the lakebed. The vegetation is characterized by a fairly open to moderate shrub canopy (18-60% cover) dominated by *Sarcobatus vermiculatus* with an herbaceous layer dominated by the rhizomatous graminoid *Distichlis spicata* (10-80% cover). Associated shrubs and dwarf-shrubs may include *Ericameria nauseosa*, *Gutierrezia sarothrae*, and *Tetradymia canescens*. *Sporobolus airoides* may codominate the graminoid layer, and *Hordeum jubatum* is common in disturbed stands. *Juncus balticus* and *Leymus cinereus* are also present in some stands. The forb layer is generally sparse and composed of species such as *Iva axillaris* and *Ipomopsis* spp. Introduced species may be present to abundant in disturbed stands.

Environment: This shrubland occupies alkaline flatlands and valley bottoms. These areas are usually closed basins. Elevation ranges from approximately 600-2300 m. It forms expansive shrublands on broad floodplains along large rivers and streams, and forms an outer ring around playas above the *Distichlis spicata*-dominated center. Flooding is generally intermittent. Substrates are deep, alkaline, saline and generally fine-textured soils with a perennial high water table. However, in southern Colorado's San Luis valley, stands grow between salt flat depressions (playas) on sandy hummocks approximately 1.2 m above the lakebed. Cryptogamic crusts are important on some sites.

Vegetation: The vegetation is characterized by a fairly open to moderate shrub canopy (18-60% cover) dominated by *Sarcobatus vermiculatus* with an herbaceous layer dominated by the rhizomatous graminoid *Distichlis spicata* (10-80% cover). Associated shrubs and dwarf-shrubs may include *Ericameria nauseosa*, *Gutierrezia sarothrae*, and *Tetradymia canescens*. *Sporobolus airoides* may codominate the graminoid layer, and *Hordeum jubatum* is common in disturbed stands. *Juncus balticus* and *Leymus cinereus* are also present in some stands. The forb layer is generally sparse and composed of species such as *Iva axillaris* and *Ipomopsis* spp. Introduced species such as *Bromus tectorum*, *Lepidium latifolium*, *Lepidium perfoliatum*, and *Bassia hyssopifolia* may be present to abundant in disturbed stands.

[From CCA: The stand described by Baker (1982b) for the Piceance Basin had patches of *Sarcobatus vermiculatus* alternating with wide expanses of *Distichlis spicata* (= *var. stricta*). A few species of annuals also were present but could not be identified. Cover of *Sarcobatus* in this stand was not high.

Data from Costello (1944b) for the San Juan Valley show dominance of *Sarcobatus*, with >60% cover, and *Chrysothamnus* spp. are associated. The understory consists primarily of *Distichlis spicata* and *Sporobolus airoides*, with *Bouteloua gracilis*, *Iva axillaris*, and *Muhlenbergia richardsonis* (= *Muhlenbergia squarrosa*) commonly present. Costello (1944b) also reported on *Sarcobatus*-dominated stands in western Colorado and Wyoming with several associated shrub species, including *Artemisia tridentata*, *Atriplex gardneri*, *Atriplex confertifolia*, and *Kochia americana*. Herbaceous species include *Elymus lanceolatus* (= *Elytrigia dasystachya*), *Salsola* spp., and *Sporobolus airoides*.

Baker (1982b) reports that many *Sarcobatus*-dominated communities are in the literature for Colorado, with understories of exotic annual weeds. His stand was one of only a few stands from western Colorado that still contains a native perennial grass understory.

Hanson (1929) reports that the appearance of greasewood stands varies greatly with depth to water table and salt concentration in the soil. It can form almost pure, tall stands, or in places be much more open with shrubs and grasses associated.]

Dynamics: *Sarcobatus vermiculatus* and *Distichlis spicata*, like many facultative halophytes, are tolerant of alkaline and saline soil conditions that allow the species to occur in sites with less interspecific competition (Ungar et al. 1969, Branson et al. 1976). *Sarcobatus vermiculatus* is often found on sites with high water tables that are intermittently flooded. Hansen et al. (1995) reported that it can tolerate saturated soil conditions for up to 40 days. *Sarcobatus vermiculatus*-dominated vegetation can occur as a narrow band along a stream, a broad floodplain shrubland, or as a mosaic of communities where composition and density of the shrub and understory species vary with depth to water table, salinity and alkalinity, soil texture, and past land use or disturbance. This shrubland may occur as a band of abrupt concentric rings of vegetation around a salt flat or depression. This visible zonation is caused by the change in dominant species and their relative tolerances to soil salinity and depth to groundwater.

The warm-season grass *Distichlis spicata* is rhizomatous, tolerant of moderate grazing, and its roots resist trampling. Although relatively unpalatable, it can provide valuable winter forage for livestock, if needed. When grazed, *Distichlis spicata* generally increases because of reduced competition from other less grazing-tolerant species. If grazed heavily, *Distichlis spicata* will decline and may be replaced by less desirable warm-season grasses such as tumblegrass, *Schedonnardus paniculatus*, or *Hordeum jubatum* (Costello 1944b, Jones and Walford 1995). Weeds are generally not a problem because few grow well in saline soils. However, severely disturbed sites are susceptible to invasion by introduced species such as *Bromus tectorum*, *Lepidium latifolium*, *Lepidium perfoliatum*, and *Bassia hyssopifolia* (Franklin and Dyrness 1973).

Anything that raises the water table of a closed basin will result in an increase in this type, due to the resulting alkalinity of the soils. Grazing of domestic livestock decreases *Distichlis* and results in its replacement by annual weedy plants such as *Bromus tectorum*, *Chorispora* spp., and *Lepidium* spp. (Baker 1982b).

Similar Associations:

- *Sarcobatus vermiculatus* Shrubland (CEGL001357)--similar but no herbaceous layer.
- *Sarcobatus vermiculatus* / *Ericameria nauseosa* Shrubland (CEGL001362)--also occurs on playa in NV.
- *Sarcobatus vermiculatus* / *Leymus cinereus* Shrubland (CEGL001366)--occurs in similar habitats those not as saline.
- *Sarcobatus vermiculatus* / *Sporobolus airoides* Sparse Vegetation (CEGL001368)
- *Sarcobatus vermiculatus* / *Elymus elymoides* Shrubland (CEGL001372)
- *Sarcobatus vermiculatus* / *Distichlis spicata* - (*Puccinellia nuttalliana*) Shrub Herbaceous Vegetation (CEGL002146)--similar but known from the northern Great Plains and not flooded.

GRank & Reasons: G4 (96-02-01).

ELEMENT DISTRIBUTION

Range: This shrubland association occurs throughout much of the interior West from western Montana to Washington, south to Nevada, Utah and Colorado.

Nations: US

States/Provinces: CO:S1, ID:S1, MT:S2, NV?, OR:S4, UT:S?, WA:S2?, WY:S?

ELEMENT SOURCES

Authors: M.S. Reid, mod. K. Schulz, WCS **Confidence:** 1 **Identifier:** CEGL001363

References: Baker 1982b, Bourgeron and Engelking 1994, Branson et al. 1976, Costello 1944b, Crawford 2001, Daubenmire 1970, Driscoll et al. 1984, Franklin and Dyrness 1973, Hansen et al. 1995, Hanson 1929, Jones and Walford 1995, Kittel et al. 1999a, Mueggler and Stewart 1980, Ungar et al. 1969

V. HERBACEOUS VEGETATION

LEYMUS CINEREUS HERBACEOUS ALLIANCE Great Basin Lyme Grass Herbaceous Alliance

ALLIANCE CONCEPT

Summary: This grassland alliance occurs in the Intermountain West of the U.S. Sites are often gentle to moderate slopes on any aspect. Stands are found on relatively mesic, non-flooded sites such as terraces above the seasonal floodplain, uplands from toeslopes to the shoulder of the slope, broad valleys, mesic patches in semi-arid shrublands and seepage sites. Sites are relatively mesic; some have soils saturated with snowmelt, while others are subirrigated. Soils are typically deep, fine-textured, alkaline, and sometimes saline, derived from alluvium and colluvium. Vegetation included in this alliance is characterized by a sparse to dense herbaceous layer that is dominated by the tall bunchgrass *Leymus cinereus*. Other plants are found mainly between the clumps of *Leymus cinereus* or on the edges of the stand. Characteristic graminoids include *Festuca idahoensis*, *Pascopyrum smithii*, *Carex praegracilis*, *Poa secunda* (= *Poa juncifolia*), and *Puccinellia distans*. The forb layer is sparse to moderately dense with perennial species such as *Achillea millefolium*, *Antennaria microphylla*, *Aquilegia* spp., *Astragalus* spp., *Cirsium* spp., *Frasera speciosa*, *Pyrrocoma uniflora* (= *Haplopappus uniflorus*), or *Castilleja* spp. Scattered shrubs may also be present. Sparse annual forbs and grasses are seasonally present. *Leymus cinereus* is salt-tolerant, and saline sites include the more salt-tolerant species like *Pascopyrum smithii* or *Puccinellia distans*. Diagnostic of this alliance is the *Leymus cinereus*-dominated grassland.

Environment: Grasslands included in this alliance occur in the intermountain western U.S. Elevation ranges from 1000-3000 m. Climate is temperate. Mean annual precipitation ranges from 25-60 cm. Topography where the alliance is found is often gentle to moderate slopes on any aspect. It is found on relatively mesic, non-flooded sites such as terraces above the seasonal floodplain, uplands from toeslopes to the shoulder of the slope, broad valleys, mesic patches in semi-arid shrublands and seepage sites. Sites are relatively mesic; some have soils saturated with snowmelt, while others are subirrigated. Sites are often more mesic than surrounding habitats. Soils are typically deep, fine-textured loams and clays and may be only 40 cm deep on some sites. They may be saline or non-saline with pH of 7-10. Parent material includes alluvium and colluvium derived from limestone or basalt, and loess.

Upland adjacent vegetation is often grasslands or shrublands dominated by *Pseudoroegneria spicata* or *Artemisia* spp. Adjacent wetter vegetation is typically dominated by species of *Carex*, *Deschampsia*, *Juncus*, *Dasiphora* or *Salix*.

Vegetation: Vegetation included in this interior northwestern U.S. alliance has sparse to dense cover of graminoids up to 1.5 m tall that is dominated by the tall bunchgrass *Leymus cinereus*. Other plants are found mainly between the clumps of *Leymus cinereus* or on the edges of the stand. Characteristic graminoids include *Festuca idahoensis*, *Pascopyrum smithii*, *Carex praegracilis*, *Poa secunda* (= *Poa juncifolia*), and *Puccinellia distans*. The forb layer is sparse to moderately dense with perennial species such as *Achillea millefolium*, *Antennaria microphylla*, *Aquilegia* spp., *Astragalus* spp., *Cirsium* spp., *Frasera speciosa*, *Pyrrocoma uniflora* (= *Haplopappus uniflorus*), or *Castilleja* spp. Scattered shrubs may also be present, including *Symphoricarpos oreophilus*, *Artemisia tridentata*, *Ribes* spp., *Chrysothamnus viscidiflorus*, *Ericameria nauseosa*

(= *Chrysothamnus nauseosus*), and *Rosa* spp. Sparse annual forbs and grasses are seasonally present. *Leymus cinereus* is salt-tolerant and saline sites include the more salt-tolerant species like *Pascopyrum smithii* or *Puccinellia distans*.

Cooper et al. (1995) have described an *Elymus cinereus* - *Puccinellia distans* community type in southwestern Montana. Stand information was included in the description for this alliance, but it was not clear if Cooper et al.'s (1995) study included flooded stands.

Dynamics: Although it is a long-lived bunchgrass, *Leymus cinereus* does not tolerate heavy grazing or mowing below 20 cm. These grasslands are typically found in small patches and along drainages. The alliance may have been more common in broad valleys before extensive livestock use, but has declined because of overgrazing and improper haying of these grasslands (Cooper et al. 1995, Johnson and Simon 1987). *Leymus cinereus* is considered to be fire-adapted and generally resprouts after fire and recovers quite rapidly on most sites (FEIS 1998).

Comments: The *Leymus cinereus* Herbaceous Alliance (A.1204) includes stands growing on non-flooded sites in relatively mesic, non-saline or saline soils in a variety of landscape positions. Stands in intermittently flooded habitats may be somewhat artificially separated from stands in this alliance. This is because non-flooded stands, where there is subirrigation, shallow water tables or moisture from springs and seeps to supplement the soil moisture, are very similar in species structure and composition to flooded stands. The flooded stands are typically on saline bottomland sites, but may also include non-saline riparian sites. These non-flooded stands include lowland to upland sites, both saline and non-saline. Information from the literature is limited and does not separate flooded from non-flooded stands. This alliance may include types from the following authors: Cooper et al. (1995), Aldous and Shantz (1924), Stoddart (1941), Walker and Brotherson (1982), Knight et al. (1976), and Mueggler and Stewart (1980).

Stands of *Leymus cinereus* are widely distributed in the Intermountain Region and the Great Basin, but little quantitative information is available on the composition of stands in different areas. Vegetation in this alliance has been altered by livestock grazing, haying operations and plowing for many years, and its former extent is unclear. More investigation is needed to resolve these classification questions and better describe this alliance.

ALLIANCE SOURCES

Authors: K. SCHULZ, West **Identifier:** A.1204

References: Aldous and Shantz 1924, Barbour and Major 1977, Chappell et al. 1997, Christensen and Welsh 1963, Cooper et al. 1995, Daubenmire 1970, Daubenmire 1992, DeVilce 1992, FEIS 1998, Hull and Hull 1974, Johnson and Simon 1987, Knight et al. 1976, Kovalchik 1987, Mueggler and Stewart 1980, Ross et al. 1973, Sawyer and Keeler-Wolf 1995, Stoddart 1941, Thilenius et al. 1995, Walker and Brotherson 1982

LEYMUS CINEREUS HERBACEOUS VEGETATION Great Basin Lyme Grass Herbaceous Vegetation

ELEMENT CONCEPT

Summary: This association is found along lower elevation riparian corridors, and some moderately alkaline valley bottomlands. Generally, stands of this type are described as growing on sites with more soil moisture than is available to the surrounding vegetation: mesic swells and seeps, foothill ravines moist bottomlands, and along streams. In Oregon, sites are usually situated on gentle slopes in canyon bottoms. Soils are deep sandy loams, generally from alluvium, with a shallow water table. This association is found at elevations between 1000 and 2550 feet in northeastern and central Oregon, and between 3000 and 5000 feet in the Great Basin. It is typically a tall (over 1.5 m) grassland with a dense cover of *Leymus cinereus* (= *Elymus cinereus*). Other plants are found mainly between the clumps of *Leymus cinereus* or on the edges of the stand. Associated species are at much lower cover values and include *Carex douglasii*, *Rumex crispus*, *Vicia americana*, *Achillea millefolium*, *Elymus glaucus*, *Agastache urticifolia*, *Potentilla gracilis* var. *flabelliformis* (= *Potentilla flabelliformis*), and *Sidalcea oregana*. *Claytonia perfoliata* (= *Montia perfoliata*) is always associated in northwestern Oregon, while more alkaline forbs (*Suaeda* spp.) are more important in the northern Great Basin valleys. Scattered shrubs may be present, including *Symphoricarpos oreophilus*, *Artemisia tridentata*, *Ribes* spp., *Chrysothamnus viscidiflorus*, *Ericameria nauseosa* (= *Chrysothamnus nauseosus*), and *Rosa* spp.

Environment: For the most part, stands of this type are described as growing on sites with more soil moisture than is available to the surrounding vegetation: mesic swells and seeps (Thilenius et al. 1995), foothill ravines (Knight et al. 1976), moist bottomlands (Stoddart 1941), and along streams (Mueggler and Stewart 1980).

Vegetation: *Leymus cinereus* (= *Elymus cinereus*, = *Elymus condensatus* var. *pubens*), the dominant species in terms of canopy cover and aspect, forms a grass layer from 3 feet to over 5 feet tall. Other plants are found mainly between the clumps of *Leymus cinereus* or on the edges of the stand. The species listed most commonly in the literature are *Pascopyrum smithii*, *Achillea millefolium*, and *Castilleja* spp. Scattered shrubs may be present, including *Symphoricarpos oreophilus*, *Artemisia tridentata*, *Ribes* spp., *Chrysothamnus viscidiflorus*, *Ericameria nauseosa* (= *Chrysothamnus nauseosus*), and *Rosa* sp.

Similar Associations:

- *Artemisia tridentata* ssp. *tridentata* / *Leymus cinereus* Shrubland (CEGL001016)--merges into *Leymus cinereus* Herbaceous Vegetation (CEGL001479), but has a well-developed shrub layer.

- *Artemisia tridentata* ssp. *vaseyana* / *Leymus cinereus* Shrubland (CEGL001027)--merges into *Leymus cinereus* Herbaceous Vegetation (CEGL001479), but has a well-developed shrub layer.
- *Leymus cinereus* Bottomland Herbaceous Vegetation (CEGL001480)--is similar, but the relationship is unclear.
- *Leymus cinereus* - *Distichlis spicata* Herbaceous Vegetation (CEGL001481)--based on Daubenmire's (1988) *Elymus cinereus* - *Distichlis stricta* association, contains bunches of *Leymus cinereus* growing in a nearly continuous layer of the lower *Distichlis spicata* (= *Distichlis stricta*) (which generally contributes the most cover), rather than a dense, tall grass layer. *Achillea millefolium* is present in both associations, but *Pascopyrum smithii* is absent from *Leymus cinereus* - *Distichlis spicata* Herbaceous Vegetation (CEGL001481).

GRank & Reasons: G2G3Q (99-03-29). This is a very widespread community, being found in many western states, but is badly degraded everywhere. It has declined markedly throughout its range, and probably represents two or more separate community types. This type was formerly very abundant in interior valleys. Early settlers described the very tall grasslands (up to the their horses backs) in many areas. Most of these sites have been converted to agriculture. Even as described here as a broad association floristically and geographically - the size and quality of most occurrences should make it a G2. More knowledge of its distribution is needed, but it should remain a priority for conservation. Most sites are threatened by livestock grazing, agriculture, altered stream hydrology, and altered fire regime.

Comments: Stands of *Leymus cinereus* are widely distributed in the Intermountain Region and the Great Basin, but little quantitative information is available on the composition of stands in different areas. The type has been very poorly sampled, since there are only a few examples which have not been very altered from grazing and altered stream function. This is therefore a broadly defined association that could be split. This *Leymus cinereus* Herbaceous Vegetation association includes stands growing on relatively non-saline soils in a variety of landscape positions, and is based on the limited information in the literature. It is also very likely that the types found along alluvial terraces in the somewhat alkaline, mid- to high-elevation valleys in the Blue Mountains and the Basin and Range are very different from the non-alkaline, low-elevation stream drainages from the Columbia Basin. Until additional reference sites are found, the type will have to be treated as a single community.

ELEMENT DISTRIBUTION

Range: This type is found mainly in the Great Basin and the Intermountain Region, and just reaches the western part of the Northern Great Plains. Although it occupies a small amount of area in Oregon or in any western state, it has a fairly large range. Unfortunately, few high-quality remnants remain.

Nations: US

States/Provinces: CA:S1, CO:S1S2, ID:S2S3, MT:S2, OR:S2, WA:S1, WY:S2

ELEMENT SOURCES

Authors: G.P. Jones and M.P. Murray, WCS **Confidence:** 3 **Identifier:** CEGL001479

References: Aldous and Shantz 1924, Bourgeron and Engelking 1994, Daubenmire 1970, Daubenmire 1988, DeVelice 1992, Dean 1960, Driscoll et al. 1984, Johnson and Simon 1987, Knight et al. 1976, MTNHP 1988, Mueggler and Stewart 1980, Stoddart 1941, Thilenius et al. 1995, USFS 1937, Walker and Brotherson 1982

DISTICHLIS SPICATA INTERMITTENTLY FLOODED HERBACEOUS ALLIANCE Saltgrass Intermittently Flooded Herbaceous Alliance

ALLIANCE CONCEPT

Summary: This alliance occurs throughout much of the semi-arid and arid western U.S. in lowland sites such as playas, swales and terraces along washes that are intermittently flooded. The flooding is usually the result of highly localized thunderstorms. The unpredictable nature of the flooding is the key environmental factor separating this alliance from similar alliances with more predictable flooding regimes. Soils are deep, saline, alkaline and fine-textured. They generally have an impermeable layer and therefore are poorly drained. When the soil is dry, the surface usually has salt accumulations. This intermittently flooded grassland of playas and ephemeral streams has a sparse to dense herbaceous layer that is dominated by *Distichlis spicata*, sometimes occurring in nearly pure stands. The level of salinity in the soil may restrict associated species. Associated graminoids may include *Puccinellia nuttalliana*, *Hordeum jubatum*, *Pascopyrum smithii*, *Sporobolus airoides*, *Carex filifolia*, and *Juncus balticus*. Forb cover is generally low and may include *Salicornia rubra*, *Triglochin maritima*, *Suaeda calceoliformis* (= *Suaeda depressa*), *Helianthus* spp., and Asteraceae spp. Diagnostic of this alliance is the *Distichlis spicata*-dominated herbaceous layer and the presence of surface water for brief periods at unpredictable times during the growing season.

Environment: Grasslands in this western alliance occur in lowland habitats such as playas, swales and terraces along washes that are intermittently flooded. The flooding is usually the result of highly localized thunderstorms which can flood one basin and leave the next dry. The unpredictable nature of the flooding is the key environmental factor separating this alliance from similar alliances with more predictable flooding regimes. Climate is semi-arid to arid. Soil texture ranges from

clay loam to sandy clay (Johnston 1987, Redmann 1972). These soils are deep, saline and alkaline. They generally have an impermeable layer and therefore are poorly drained. When the soil is dry, the surface usually has salt accumulations.

Vegetation: Vegetation included in this alliance occurs in lowland sites throughout much of the semi-arid and arid western U.S. This is an intermittently flooded grassland of playas and intermittent and ephemeral streams. Cover is sparse to dense and is dominated by *Distichlis spicata*, occurring in nearly pure stands. Stands have higher diversity and cover during wet years and near boundaries with other vegetation types. Higher soil salinity favors *Distichlis spicata* over less salt-tolerant species. However, very high salinity will dwarf the *Distichlis spicata* and reduce cover. Generally, vegetation height and cover, and species diversity tend to vary inversely with salinity (Ungar 1967, Steinauer 1989). Associated species may be restricted by the level of salinity in the soil. Those from higher soil salinity sites may include the graminoid *Puccinellia nuttalliana* and the forbs *Salicornia rubra*, *Triglochin maritima*, and *Suaeda calceoliformis* (= *Suaeda depressa*). Species from lower salinity sites include the graminoids *Hordeum jubatum*, *Pascopyrum smithii*, *Sporobolus airoides*, *Carex filifolia*, and *Juncus balticus*, and the forbs *Helianthus* spp. and Asteraceae spp. (Ungar 1974). Forb cover is generally low. Shrubs are rare, but may include scattered *Atriplex canescens* and *Sarcobatus vermiculatus*.

Dynamics: The intermittent flooding regime combined with high evaporation rate in these dry climates causes accumulations of soluble salts in the soil. Total vegetation cover (density and height), species composition, and soil salinity depend on the amount and timing of precipitation and flooding. Growth-inhibiting salt concentrations are diluted when the soil is saturated allowing the growth of less salt-tolerant species and more robust growth of *Distichlis spicata*. As the saturated soils dry, the salt concentrates until it precipitates on the soil surface (Dodd and Coupland 1966, Ungar 1968). This osmotic stress of growing in alkaline and saline soils is compensated by the accumulation of proline by some halophytic species including *Distichlis spicata*. This aids the plants' water uptake by increasing the osmotic potential of the plant (Shupe et al. 1986). Vegetation forms zones at some saline sites, where species abundance is stratified by salt tolerance (Shupe et al. 1986, Ungar et al. 1969). In playas, the soil salinity at field capacity generally increases from the edge to the center allowing for several different vegetation stands to co-occur (Ungar 1967, 1970, Ungar et al. 1969). Microtopography can also affect vegetation structure. Where soil accumulates to form hummocks, less salt- and alkali-tolerant plants can occur (Ungar 1972, Johnson 1987).

Distichlis spicata is rhizomatous and is tolerant of moderate grazing and its roots resist trampling. Although relatively unpalatable, it can provide valuable winter forage for livestock if needed. If grazed heavily, *Distichlis spicata* will decline and may be replaced by less desirable warm-season grasses such as tumblegrass, *Schedonnardus paniculatus* (Costello 1944b). Weeds are generally not a problem because few grow well in saline soils.

Comments: The classification of vegetation in this alliance is difficult for two reasons. First, *Distichlis spicata* is a widespread halophytic grass species that dominates or codominates the herbaceous layer of stands classified into many different associations in several different alliances. This results in many closely related associations in other alliances where this grass is a diagnostic species. Secondly, most of these related alliances have an intermittent, temporary, seasonal or tidal flood regime. These flood regimes sometimes separate vegetation that otherwise is very similar. For example, the flood regime that separates this alliance from the *Distichlis spicata* - (*Hordeum jubatum*) Temporarily Flooded Herbaceous Alliance (A.1341) can be somewhat arbitrary in regions that have large year-to-year variation in precipitation.

ALLIANCE SOURCES

Authors: K. SCHULZ, West **Identifier:** A.1332

References: Baker 1984a, Beatley 1976, Brotherson 1987, Bunin 1985, Copeland 1979, Costello 1944b, Crouch 1961a, Daniels 1911, Daubenmire 1970, Franklin and Dyrness 1973, Graham 1937, Griffiths 1902, Hansen et al. 1991, Hansen et al. 1995, Henrickson 1974, Hyder et al. 1966, Johnston 1987, Jones and Walford 1995, Kittel and Lederer 1993, Kittel et al. 1994, Klipple and Costello 1960, Osborn 1974, Ralston 1969, Ramaley 1942, Redmann 1972, Rogers 1953, Saul 1974, Shanks 1977, Shupe et al. 1986, Soil Conservation Service 1978, Soil Conservation Service n.d., Stearns-Roger Inc. 1978, Steinauer 1989, Tuhy and Jensen 1982, Ungar 1967, Ungar 1968, Ungar 1970, Ungar 1972, Ungar 1974b, Ungar 1974c, Ungar et al. 1969, Vestal 1914, Weaver and Albertson 1956

DISTICHLIS SPICATA HERBACEOUS VEGETATION Saltgrass Herbaceous Vegetation

ELEMENT CONCEPT

Summary: These grasslands occur in semi-arid and arid western North America from southern Saskatchewan to Mexico. Stands are found in lowland habitats such as playas, swales and terraces along washes that are typically intermittently flooded. The flooding is usually the result of highly localized thunderstorms which can flood one basin and leave the next dry. However, this association may also occur in other flood regimes (temporarily, seasonally, and semipermanently). Soil texture ranges from clay loam to sandy clay. These soils are often deep, saline and alkaline. They generally have an impermeable layer and therefore are poorly drained. When the soil is dry, the surface usually has salt accumulations. Salinity is likely more important than flooding as an environmental factor. Vegetation cover is sparse to dense and is dominated by *Distichlis spicata*, occurring in nearly pure stands. Minor cover of associated graminoids may include *Muhlenbergia asperifolia*, *Hordeum jubatum*, *Pascopyrum smithii*, *Sporobolus airoides*, *Carex filifolia*, *Eleocharis palustris*, *Puccinellia*

nuttalliana, and *Juncus balticus*. Associated forbs, such as *Iva axillaris*, *Helianthus* spp., Asteraceae spp. (from lower salinity sites), *Salicornia rubra*, *Triglochin maritima*, and *Suaeda* spp., may also be present. Shrubs are rare, but scattered *Atriplex canescens* and *Sarcobatus vermiculatus* may be present.

Environment: These grasslands occur in the semi-arid and arid western North America from southern Saskatchewan to Mexico. Elevation ranges from 1000-2300 m. Stands are found in lowland habitats such as playas, swales and terraces along washes that are typically intermittently flooded. The flooding is usually the result of highly localized thunderstorms which can flood one basin and leave the next dry. However, this association may also occur in other flood regimes (temporarily, seasonally, and semipermanently). Soil texture ranges from clay loam to sandy clay (Johnston 1987). These soils are often deep, saline and alkaline. They generally have an impermeable layer and therefore are poorly drained. When the soil is dry, the surface usually has salt accumulations. Salinity is likely more important than flooding as an environmental factor.

Vegetation: Vegetation included in this association occurs in lowland sites throughout much of the semi-arid and arid western U.S. This is an intermittently flooded grassland of playas and intermittent and ephemeral streams. Cover is sparse to dense and is dominated by *Distichlis spicata*, occurring in nearly pure stands. Stands have higher diversity and cover during wet years and near boundaries with other vegetation types. Higher soil salinity favors *Distichlis spicata* over less salt-tolerant species. However, very high salinity will dwarf the *Distichlis spicata* and reduce cover. Generally, vegetation height and cover and species diversity tend to vary inversely with salinity on the plains, but may increase on very saline sites (Brotherson 1987). Minor cover of associated graminoids may include *Muhlenbergia asperifolia*, *Hordeum jubatum*, *Pascopyrum smithii*, *Sporobolus airoides*, *Carex filifolia*, *Eleocharis palustris*, *Puccinellia nuttalliana*, and *Juncus balticus*. Associated forbs, such as *Iva axillaris*, *Helianthus* spp. and Asteraceae spp. (from lower salinity sites), *Salicornia rubra*, *Triglochin maritima*, and *Suaeda* spp., may also be present. Shrubs are rare, but scattered *Atriplex canescens* and *Sarcobatus vermiculatus* may be present. Introduced species are present in some stands and may include *Elymus repens*, *Lepidium latifolium*, *Lepidium perfoliatum*, *Bassia scoparia* (= *Kochia scoparia*), and occasionally *Tamarix* spp.

Dynamics: The intermittent flooding regime combined with the high evaporation rate in these dry climates causes accumulations of soluble salts in the soil. Total vegetation cover (density and height), species composition, and soil salinity depend on the amount and timing of precipitation and flooding. Growth-inhibiting salt concentrations are diluted when the soil is saturated allowing the growth of less salt-tolerant species and more robust growth of *Distichlis spicata*. As the saturated soils dry, the salt concentrates until it precipitates on the soil surface (Dodd and Coupland 1966, Ungar 1968). This osmotic stress of growing in alkaline and saline soils is compensated by the accumulation of proline by some halophytic species including *Distichlis spicata*. This aids the plants' water uptake by increasing the osmotic potential of the plant (Shupe et al. 1986). Vegetation forms zones at some saline sites, where species abundance is stratified by salt tolerance (Shupe et al. 1986, Ungar et al. 1969). In playas, the soil salinity at field capacity generally increases from the edge to the center allowing for several different vegetation stands to co-occur (Ungar 1967, 1970, Ungar et al. 1969). Microtopography can also affect vegetation structure. Where soil accumulates to form hummocks, less salt- and alkali-tolerant plants can occur (Ungar 1972, Johnston 1987).

Brotherson (1987) studied species in a saline meadow adjacent to the Great Salt Lake in Utah and found 5 vegetation zones all with *Distichlis spicata* present. The meadow sloped down and away from the shoreline for the first 4 zones, then up for the last. Soil pH and soluble salts levels followed the slope pattern with the lowest zone (4) having lower pH and salt concentrations and the highest cover of *Distichlis spicata* (99%) almost exclusively. The other higher salt zones were codominated by other species such as *Suaeda calceoliformis*, *Puccinellia nuttalliana*, *Salicornia rubra*, *Triglochin maritima*, *Glaux maritima*, or *Eleocharis palustris*. Zone 5 was dominated by *Eleocharis palustris* and had additional moisture from a nearby seep. The salts were concentrated in the higher elevation zones because of evaporation of the salt-laden water that was leached from the lower lying areas.

The warm-season grass *Distichlis spicata* is rhizomatous, tolerant of moderate grazing, and its roots resist trampling. Although relatively unpalatable, it can provide valuable winter forage for livestock, if needed. When grazed, *Distichlis spicata* generally increases because of reduced competition from other less grazing-tolerant species. If grazed heavily, *Distichlis spicata* will decline and may be replaced by less desirable warm-season grasses such as tumblegrass, *Schedonnardus paniculatus*, or *Hordeum jubatum* (Costello 1944b, Jones and Walford 1995). Weeds are generally not a problem because few grow well in saline soils. However, severely disturbed sites are susceptible to invasion by introduced species such as *Bromus tectorum*, *Lepidium latifolium*, *Lepidium perfoliatum*, and *Bassia hyssopifolia* (Franklin and Dyrness 1973).

Similar Associations:

- *Leymus cinereus* - *Distichlis spicata* Herbaceous Vegetation (CEGL001481)
- *Pascopyrum smithii* - *Distichlis spicata* Herbaceous Vegetation (CEGL001580)
- *Sporobolus airoides* - *Distichlis spicata* Herbaceous Vegetation (CEGL001687)
- *Distichlis spicata* Mixed Herb Herbaceous Vegetation (CEGL001771)
- *Distichlis spicata* - *Lepidium perfoliatum* Herbaceous Vegetation (CEGL001772)
- *Distichlis spicata* - (*Scirpus nevadensis*) Herbaceous Vegetation (CEGL001773)
- *Eleocharis palustris* - *Distichlis spicata* Herbaceous Vegetation (CEGL001834)

- *Distichlis spicata* - *Hordeum jubatum* - (*Poa arida*, *Iva annua*) Herbaceous Vegetation (CEGL002031)--currently described only from the Great Plains.
- *Polygonum* spp. - *Echinochloa* spp. - *Distichlis spicata* Playa Lake Herbaceous Vegetation (CEGL002039)
- *Distichlis spicata* - (*Hordeum jubatum*, *Poa arida*, *Sporobolus airoides*) Herbaceous Vegetation (CEGL002042)--currently described only from the Great Plains.
- *Distichlis spicata* - *Schoenoplectus maritimus* - *Salicornia rubra* Herbaceous Vegetation (CEGL002043)--currently described only from the Great Plains.
- *Distichlis spicata* - *Hordeum jubatum* - *Puccinellia nuttalliana* - *Suaeda calceoliformis* Herbaceous Vegetation (CEGL002273)--currently described only from the Great Plains.
- *Distichlis spicata* - *Spartina* spp. Herbaceous Vegetation (CEGL002275)--currently described only from the Great Plains.
- *Distichlis spicata* - *Hordeum jubatum* - *Puccinellia nuttalliana* - *Plantago maritima* Herbaceous Vegetation (CEGL002551)--currently described only from the Great Plains.

GRank & Reasons: G5 (96-02-01).

Comments: This graminoid association is characteristically dominated by *Distichlis spicata*. Closely related communities include *Pascopyrum smithii* - *Distichlis spicata* Herbaceous Vegetation (CEGL001580), *Sporobolus airoides* - *Distichlis spicata* Herbaceous Vegetation (CEGL001687), and several others.

ELEMENT DISTRIBUTION

Range: This grassland association occurs in low areas in semi-arid and arid western North America from southern Saskatchewan to Mexico.

Nations: CA MX? US

States/Provinces: AZ:S3, CA:S3, CO:S3, ID:S4, MT:S4, NM:S4, NV:S?, OR:S4, SK:S?, UT:S3S5, WA:S1?, WY:S3

ELEMENT SOURCES

Authors: K.A. Schulz, WCS **Confidence:** 2 **Identifier:** CEGL001770

References: Baker 1984a, Beatley 1976, Bourgeron and Engelking 1994, Brotherson 1987, Bunin 1985, Costello 1944b, Crouch 1961a, Daniels 1911, Daubenmire 1970, Dodd and Coupland 1966, Driscoll et al. 1984, Franklin and Dyrness 1973, Graham 1937, Hansen et al. 1991, Hansen et al. 1995, Hyder et al. 1966, Johnston 1987, Jones and Walford 1995, Kittel and Lederer 1993, Kittel et al. 1994, Kittel et al. 1999a, Klipple and Costello 1960, Muldavin et al. 2000a, Osborn 1974, Ralston 1969, Ramaley 1942, Rogers 1953, Sawyer and Keeler-Wolf 1995, Shanks 1977, Shupe et al. 1986, Soil Conservation Service 1978, Stearns-Roger Inc. 1978, Tuhy and Jensen 1982, Ungar 1967, Ungar 1968, Ungar 1970, Ungar et al. 1969, Vestal 1914, Weaver and Albertson 1956

HORDEUM JUBATUM TEMPORARILY FLOODED HERBACEOUS ALLIANCE

Foxtail
Barley Temporarily Flooded Herbaceous Alliance

ALLIANCE CONCEPT

Summary: This alliance is found in the northern and western Great Plains and is dominated by short and medium-tall graminoids with a total vegetation cover of nearly 100%. Shrubs are often absent, and forbs are present but not usually abundant. *Hordeum jubatum* is the dominant species. Other common species include *Elymus trachycaulus*, *Distichlis spicata*, *Pascopyrum smithii*, *Poa arida*, *Poa compressa*, *Rumex crispus*, and *Sonchus arvensis*. Stands are located in lowlands with moderately to strongly saline soils. The topography is flat and the soils are often briefly flooded or saturated in the spring.

Environment: Stands included in this alliance have been reported from lowlands across the northern Great Plains, in intermountain parks in Colorado and northeastern Utah. The climate is semi-arid continental with mean annual precipitation of 25-48 cm. Elevation generally ranges from 750-1600 m, and up to 2600 m in South Park, Colorado. The topography is flat and the soils are often briefly flooded or saturated in the spring (Redmann 1972). It is also found in the drawdown zone of ponds with moderately saline water (Hansen et al. 1995). Soils are clay loam to clay and poor to very poorly drained. Soil salinity is somewhat variable. Wilson (1967) found *Hordeum jubatum* grew best in non-saline soils in laboratory conditions. In the field with competition, this grass grew best in moderately saline conditions (up to 0.7% salinity). The soil surface may be covered with white salt crusts with moderately to strongly saline soils (Barnes 1978, Wilson 1967, Ungar 1969, Hansen et al. 1995). Adjacent wetter sites are often open water, while surrounding uplands can be dominated by a variety of grasslands or shrublands.

Vegetation: Grasslands included in this alliance are found in lowland sites in the northern and western Great Plains. The vegetation is a sparse to dense layer of short and medium-tall graminoids dominated by the cool-season, short-lived, perennial bunchgrass *Hordeum jubatum*. It often occurs in nearly pure stands. Ungar (1969) described one stand that was dominated by *Hordeum jubatum* in the spring and early summer, then became dominated by *Iva annua* in the late summer. Total vegetation cover is usually high, but can range from 20% to nearly 100% (Barnes 1978, Hansen et al. 1995). Shrubs are often absent and forbs are present, but not usually abundant. Species diversity is typically low. Other species include

Chenopodium spp., *Distichlis spicata*, *Eleocharis* spp., *Elymus trachycaulus*, *Iva annua*, *Pascopyrum smithii*, *Poa arida*, *Poa compressa*, *Puccinellia nuttalliana*, *Rumex crispus*, *Salicornia rubra*, and *Schoenoplectus maritimus* (= *Scirpus paludosus*).

Dynamics: *Hordeum jubatum* is a common, short-lived pioneer species of mesic prairie habitats where permanent grass cover has been destroyed (Dodd and Coupland 1966). It may represent a seral stage that will be taken over by more permanent grasses (Hansen et al. 1995). It is moderately salt-tolerant and can densely colonize areas disturbed by flooding along drainages, around playas and more permanent ponds. *Hordeum jubatum* is moderately tolerant of salinity. Often on playas, these grasslands occupy a zone of intermediate salinity between halophytic vegetation dominated by *Distichlis spicata*, *Puccinellia nuttalliana*, or *Salicornia rubra*, and non-saline, mesic prairie vegetation dominated by *Pascopyrum smithii*, *Poa* spp. or *Elymus* spp. Total vegetation cover (density and height), species composition and soil salinity depend on the amount and timing of precipitation and flooding. Growth-inhibiting salt concentrations are diluted when the soil is saturated, allowing the growth of less salt-tolerant species and more robust growth (Ungar 1967).

Comments: This alliance is poorly defined. Where their ranges overlap, the relationship between this alliance and communities within the *Distichlis spicata* - (*Hordeum jubatum*) Temporarily Flooded Herbaceous Alliance (A.1341) is unclear. Stands in both alliances usually contain *Distichlis spicata* and *Hordeum jubatum* in varying amounts. The presence of *Puccinellia nuttalliana* or *Suaeda calceoliformis* may be distinguishing factors of the latter alliance. They appear to be more characteristic of strongly to very strongly saline areas, while *Hordeum jubatum* often dominates on less saline sites (Redmann 1972). Classification problems may arise on intermediate sites when *Hordeum jubatum* is the dominant species and *Distichlis spicata*, *Puccinellia nuttalliana*, and *Suaeda calceoliformis* are present in minor amounts. Some communities in the *Pascopyrum smithii* Herbaceous Alliance (A.1232) may be similar to, and may adjoin, the less saline portion of stands of this alliance in North Dakota.

ALLIANCE SOURCES

Authors: K. SCHULZ, West **Identifier:** A.1358

References: Baker 1984a, Barnes and Tieszen 1978, Bunin 1985, Dodd and Coupland 1966, Faber-Langendoen et al. 1996, Hansen et al. 1988b, Hansen et al. 1991, Hansen et al. 1995, Redmann 1972, Reid 1974, Ungar 1967, Ungar et al. 1969, Vestal 1914

HORDEUM JUBATUM HERBACEOUS VEGETATION Foxtail Barley Herbaceous Vegetation

ELEMENT CONCEPT

Summary: This foxtail barley community type is found in the northern and central Great Plains of the United States and Canada, Utah and may occur elsewhere in the interior western U.S. Stands are found in lowlands with moderately to strongly saline soils. The topography is flat and the soils are often flooded or saturated in the spring. The vegetation is dominated by short and medium tall graminoids with a total vegetation cover of nearly 100%. Shrubs are usually absent. *Hordeum jubatum* dominates the community. Other common species in this community are *Elymus trachycaulus*, *Distichlis spicata*, *Pascopyrum smithii*, *Poa arida*, *Poa compressa*, and *Rumex crispus*.

Environment: This association has been reported from lowlands across the northern Great Plains, in intermountain parks in Colorado and northeastern Utah. The climate is semi-arid continental with mean annual precipitation of 25-48 cm. Elevation generally ranges from 750-1600 m, and up to 2600 m in South Park, Colorado. Stands are located in lowlands with moderately to strongly saline soils (Barnes and Tieszen 1978). The topography is flat, and the soils are often flooded or saturated in the spring (Redmann 1972). *Hordeum jubatum* is often found dominating disturbed areas such as roadsides and over-grazed bottomland.

Vegetation: The typically dense vegetation is dominated by short and medium-tall graminoids with a total vegetation cover of nearly 100%, but may occur in sparser stands (25-30% cover) (Barnes and Tieszen 1978, Von Loh 2000). Shrubs are usually absent. *Hordeum jubatum* dominates the community. Other common species in this community are *Elymus trachycaulus*, *Distichlis spicata*, *Pascopyrum smithii*, *Poa arida*, *Poa compressa*, *Rumex crispus*, *Ambrosia tomentosa*, and *Malvella leprosa*. Introduced species may be common in some stands including *Bassia scoparia* (= *Kochia scoparia*), *Sonchus arvensis*, and *Lepidium latifolium*.

Dynamics: Total vegetation cover (density and height), species composition, and soil salinity depend on the amount and timing of precipitation and flooding. Growth-inhibiting salt concentrations are diluted when the soil is saturated, allowing the growth of less salt-tolerant species and more robust growth (Ungar 1967). *Hordeum jubatum* will replace *Distichlis spicata* in those communities when heavily grazed (Jones and Walford 1995).

Similar Associations:

- *Distichlis spicata* - *Hordeum jubatum* - *Puccinellia nuttalliana* - *Suaeda calceoliformis* Herbaceous Vegetation (CEGL002273)
- *Pascopyrum smithii* - *Hordeum jubatum* Herbaceous Vegetation (CEGL001582)
- *Distichlis spicata* - *Hordeum jubatum* - (*Poa arida*, *Iva annua*) Herbaceous Vegetation (CEGL002031)
- *Distichlis spicata* - (*Hordeum jubatum*, *Poa arida*, *Sporobolus airoides*) Herbaceous Vegetation (CEGL002042)
- *Distichlis spicata* - *Hordeum jubatum* - *Puccinellia nuttalliana* - *Plantago maritima* Herbaceous Vegetation (CEGL002551)

- *Schoenoplectus robustus* - *Juncus gerardii* - *Hordeum jubatum* - *Atriplex patula* Herbaceous Vegetation (CEGL006234)

GRank & Reasons: G4 (96-02-01).

Comments: This type is poorly defined. This abstract is based on two descriptions of *Hordeum jubatum*-dominated stands which are assumed to be examples of this community. These stands may be variants of *Distichlis spicata* - *Hordeum jubatum* - *Puccinellia nuttalliana* - *Suaeda calceoliformis* Herbaceous Vegetation (CEGL002273) and *Pascopyrum smithii* - *Hordeum jubatum* Herbaceous Vegetation (CEGL001582). The relationship between *Hordeum jubatum* Herbaceous Vegetation (CEGL001798) and these types is unclear. Both communities usually contain *Hordeum jubatum* and *Distichlis spicata* or *Pascopyrum smithii* in varying amounts. The presence of *Puccinellia nuttalliana* or *Suaeda calceoliformis* may be distinguishing factors. They appear to be more characteristic of strongly saline areas while *Hordeum jubatum* can dominate on less saline sites (Redmann 1972). Classification problems may arise on intermediate sites when *Hordeum jubatum* is the dominant species and *Distichlis spicata*, *Pascopyrum smithii*, *Puccinellia nuttalliana*, and *Suaeda calceoliformis* are present in more than minor amounts.

ELEMENT DISTRIBUTION

Range: This foxtail barley community type is found in the northern and central Great Plains of the United States and Canada, ranging from Colorado to Saskatchewan. It is also described from Utah and may occur elsewhere in the interior West.

Nations: CA US

States/Provinces: CO:S3?, MT:S4, ND:S?, SD?, SK:S?, UT:S?

ELEMENT SOURCES

Authors: J. Drake, mod. K. Schulz, WCS **Confidence:** 3 **Identifier:** CEGL001798

References: Baker 1984a, Barnes and Tieszen 1978, Bourgeron and Engelking 1994, Bunin 1985, Driscoll et al. 1984, Hansen et al. 1991, Hansen et al. 1995, Jones and Walford 1995, Redmann 1972, Reid 1974, Ungar 1967, Vestal 1914, Von Loh 2000

PASCOPYRUM SMITHII TEMPORARILY FLOODED HERBACEOUS ALLIANCE Western Wheatgrass Temporarily Flooded Herbaceous Alliance

ALLIANCE CONCEPT

Summary: This alliance is found in the northern Great Plains. Stands are dominated by graminoids, the tallest of which may rarely reach 1 m. Most of the vegetation is 0.6 m or less. The depth to the clay layer affects the height and amount of vegetation. The deeper the clay layer is buried, the more dense the vegetation. The dominants are *Distichlis spicata*, *Hordeum jubatum*, and *Pascopyrum smithii*. Other common graminoids include *Bouteloua gracilis*, *Koeleria macrantha*, *Hesperostipa comata* (= *Stipa comata*), and *Carex duriuscula* (= *Carex eleocharis*). Forbs that may be present include *Iva annua*, *Helianthus petiolaris*, *Plantago patagonica*, *Gutierrezia sarothrae*, and Asteraceae spp. Woody plants are rare. Some stands may have scattered *Artemisia frigida*, *Artemisia cana*, or *Symphoricarpos occidentalis*.

This alliance is found in depressions and on stream terraces on moderately saline silt loam and sandy loam soils, sometimes with a clay subsoil. The soils are wet for part of the year and may flood periodically.

Environment: This northwestern Great Plains alliance occurs at low to moderate elevations, from about 760 m to over 1100 m. Climate is temperate continental, semi-arid to subhumid. Precipitation often occurs during the winter and spring as snow or rain, and during the summer as thunderstorms. Stands are found in playas and on stream terraces that are temporarily flooded for part of the growing season. Sites are flat to gently sloping on any aspect. Substrates are moderately saline, often poorly drained, ranging in soil texture from clay and silty clay to silty loam and sandy loam with a clay subsoil (Hanson and Whitman 1938, Johnston 1987, Jones and Walford 1995). In Wyoming playas, stands are found on clay and clay loam soils (Jones and Walford 1995). In playas, this clay or clay loam subsoil impedes infiltration and allows for mesic moisture regimes. Johnston (1987) reports alkaline pH's ranging from 7.2-8.3, and acid pH's ranging from 5.8-6.5, but his source for this information is unclear. Much of the ground is bare (to 75% in some stands).

Adjacent vegetation is upland mid- or shortgrass prairie often dominated by *Schizachyrium scoparium*, *Hesperostipa comata*, *Bouteloua gracilis* or *Pascopyrum smithii*.

Vegetation: Grasslands in this alliance is found along intermittent and ephemeral streams and playas in the northern Great Plains. Stands are dominated by sparse to dense cover of graminoids, up to 1 m tall, although most of the vegetation is 0.6 m tall or shorter. The depth to the clay layer affects the height and amount of vegetation, i.e., the deeper the clay layer the denser the vegetation (Hirsch 1985). The herbaceous layer is dominated or codominated by *Pascopyrum smithii* with *Distichlis spicata*, *Hordeum jubatum*, *Eleocharis acicularis* or *Eleocharis palustris* often codominating. Other common graminoids include *Bouteloua gracilis*, *Juncus balticus*, *Koeleria macrantha*, *Hesperostipa comata* (= *Stipa comata*), and *Carex duriuscula* (= *Carex eleocharis*). Forbs that may be present include *Iva annua*, *Helianthus petiolaris*, *Plantago patagonica*, and Asteraceae spp. Woody plants are rare. Some stands may have scattered woody species such as the dwarf-shrubs *Gutierrezia sarothrae* or *Artemisia frigida*, or the shrubs *Artemisia cana* or *Symphoricarpos occidentalis*. The

temporary flooding regime combined with high evaporation rates in these dry climates causes accumulations of soluble salts in the soil. Total vegetation cover (density and height), species composition, and soil salinity depend on the amount and timing of precipitation and flooding. In playas, growth-inhibiting salt concentrations are diluted when the soil is saturated allowing the growth of less salt-tolerant species such as *Pascopyrum smithii*. As the saturated soils dry, the salt concentrates until it precipitates on the soil surface (Dodd and Coupland 1966). Vegetation forms zones at some saline sites, where species abundances are stratified by salt tolerance. In playas, the soil salinity at field capacity generally increases from the edge to the center allowing for several different vegetation stands to co-occur (Ungar 1967, 1969, 1970). Also within a vegetation type more mesic or salt-tolerant species such *Eleocharis acicularis*, *Eleocharis palustris*, *Juncus balticus*, and *Alopecurus* spp. will be more common at lower topographic levels where flooding is more frequent, than the dry-mesic species such as *Pascopyrum smithii*.

Pascopyrum smithii is rhizomatous and is tolerant of moderate grazing. If severely over-grazed, *Pascopyrum smithii* will decline and may be replaced by less desirable warm-season grasses and exotic species such as *Poa pratensis*.

Dynamics: The temporary flooding regime combined with high evaporation rates in these dry climates causes accumulations of soluble salts in the soil. Total vegetation cover (density and height), species composition, and soil salinity depend on the amount and timing of precipitation and flooding. In playas, growth-inhibiting salt concentrations are diluted when the soil is saturated allowing the growth of less salt-tolerant species such as *Pascopyrum smithii*. As the saturated soils dry, the salt concentrates until it precipitates on the soil surface (Dodd and Coupland 1966). Vegetation forms zones at some saline sites, where species abundance is stratified by salt tolerance. In playas, the soil salinity at field capacity generally increases from the edge to the center allowing for several different vegetation stands to co-occur (Ungar 1967, 1969, 1970). Also within a vegetation type more mesic or salt-tolerant species such *Eleocharis acicularis*, *Eleocharis palustris*, *Juncus balticus*, and *Alopecurus* spp. will be more common at lower topographic levels where flooding is more frequent, than the dry-mesic species such as *Pascopyrum smithii*. *Pascopyrum smithii* is rhizomatous and is tolerant of moderate grazing. If severely over-grazed, *Pascopyrum smithii* will decline and may be replaced by less desirable warm season grasses and exotic species such as *Poa pratensis*.

Comments: This alliance is closely related to the V.A.5.N.j *Distichlis spicata* - (*Hordeum jubatum*) Temporarily Flooded Herbaceous Alliance (A.1341), and stands of this alliance may be found on the less saline edges of that one. More work needs to be done to better define differences between these two alliances. Some stands of this alliance may be similar to stands in the V.A.5.N.c *Pascopyrum smithii* Herbaceous Alliance (A.1232). Most of the latter alliance is found on drier and much less saline soils. Some associations currently placed in this alliance, those in playas or along intermittent streams that are dependent on unpredictable summer rain events for moisture, may be better classified in the V.A.5.N.i *Pascopyrum smithii* Intermittently Flooded Herbaceous Alliance (A.1328).

In some stands of this alliance, *Distichlis spicata* may dominate, but contribution of at least 25% of the canopy cover by *Pascopyrum smithii* is diagnostic; stands with <25% of the cover contributed by *Pascopyrum smithii* belong to the *Distichlis spicata* Intermittently Flooded Herbaceous Alliance (A.1332). In general, a stand must have at least 25% cover of *Pascopyrum smithii* to be included in this alliance.

ALLIANCE SOURCES

Authors: MCS, MOD. M.S. REID/K. SC, West **Identifier:** A.1354

References: BLM 1979b, Britton 1979, Caballo Rojo Mine Application n.d., Culver et al. 1996, Diamond 1993, Dodd and Coupland 1966, Faber-Langendoen et al. 1996, Hanson and Whitman 1938, Harner-White Consultants n.d., Hirsch 1985, Hoagland 1998a, Holpp 1977, Johnston 1987, Jones and Walford 1995, Medicine Bow Mine Application n.d., Mine Reclamation Consultants 1977, NVS Corporation n.d., Stoecker-Keammerer Consultants n.d.(a), Stoecker-Keammerer Consultants n.d.(c), Ungar 1967, Ungar 1970, Western Resources Development Corporation n.d. (b), Western Resources Development Corporation n.d. (c)

PASCOPYRUM SMITHII - DISTICHLIS SPICATA HERBACEOUS VEGETATION Western Wheatgrass - Saltgrass Herbaceous Vegetation

ELEMENT CONCEPT

Summary: This western wheatgrass saline prairie type is found in the northern Great Plains of the United States. Stands occur in depressions and on (ephemeral) stream terraces on deep, moderately saline soils, sometimes with a clay subsoil. These soils are wet for part of the year and may flood periodically. The vegetation is dominated by graminoids, which may be as tall as 1 m, but typically are less than 0.6 m. The dominants are *Pascopyrum smithii* and *Distichlis spicata*. Other common graminoids include *Bouteloua gracilis*, *Koeleria macrantha*, *Hesperostipa comata* (= *Stipa comata*), *Hordeum jubatum*, and *Carex duriuscula* (= *Carex eleocharis*). Forbs that may be present are *Iva annua*, *Helianthus petiolaris*, *Plantago patagonica*, *Gutierrezia sarothrae*, and Asteraceae spp., including *Symphyotrichum falcatum* (= *Aster falcatus*). Woody plants are minor species, but *Artemisia tridentata* ssp. *wyomingensis*, *Artemisia cana* ssp. *cana*, and *Populus*

deltoides are present in some stands. In Nebraska, alkaline indicators, such as *Muhlenbergia asperifolia* and *Sporobolus airoides*, may also be present.

Environment: This community is found in depressions and on stream terraces, including ephemeral streams. Stands contain moderately saline silt loam and sandy loam soils, sometimes with a clay subsoil (Hanson and Whitman 1938, Johnston 1987, Steinauer and Rolfsmeier 2000). Hirsch (1985) found the clay layer to be 0-25 cm below the surface. The soils are wet for part of the year and may flood periodically.

Vegetation: The vegetation is dominated by graminoids, which may be as tall as 1 m, but typically are less than 0.6 m. The depth to the clay layer affects the height and amount of vegetation, and the deeper the clay layer is buried, the taller the vegetation (Hirsch 1985). The dominants are *Pascopyrum smithii* and *Distichlis spicata*. Other common graminoids include *Bouteloua gracilis*, *Koeleria macrantha*, *Hesperostipa comata* (= *Stipa comata*), *Hordeum jubatum*, and *Carex duriuscula* (= *Carex eleocharis*). Forbs that may be present are *Iva annua*, *Helianthus petiolaris*, *Plantago patagonica*, *Gutierrezia sarothrae*, and members of the Asteraceae (including *Symphyotrichum falcatum* (= *Aster falcatus*)). Woody plants are rare. In Wyoming, some stands may have scattered *Artemisia frigida* or *Artemisia cana* ssp. *cana*. In Nebraska stands may have scattered *Populus deltoides*. There, alkaline indicators, such as *Muhlenbergia asperifolia* and *Sporobolus airoides*, may also be present. Exotic species, principally *Atriplex micrantha* (= *Atriplex heterosperma*) and *Cirsium arvense*, are ubiquitous and may contribute substantial cover in many stands (Steinauer and Rolfsmeier 2000).

Similar Associations:

- *Pascopyrum smithii* - *Hordeum jubatum* Herbaceous Vegetation (CEGL001582)--is found further east; however, the floristic and environmental differences between these communities appear to be slight. Further review has to be completed to determine if there are enough differences to maintain the separate communities.
- *Distichlis spicata* - (*Hordeum jubatum*, *Poa arida*, *Sporobolus airoides*) Herbaceous Vegetation (CEGL002042)
- *Sporobolus airoides* Northern Plains Herbaceous Vegetation (CEGL002274)

GRank & Reasons: G4 (96-02-01). The G4 rank is based on a large geographic range and rather general environmental requirements. In light of the ubiquity of exotic plants in this type and the large proportion of stands in Nebraska (and perhaps elsewhere) that have been heavily disturbed by livestock (Steinauer and Rolfsmeier 2000), the rank probably should be reviewed.

Comments: This type is somewhat complex, with *Pascopyrum smithii* more important in less saline/alkaline areas, and *Distichlis spicata* and other alkaline indicators present in more alkaline areas. As such this type tends to share similarities to *Distichlis spicata* - (*Hordeum jubatum*, *Poa arida*, *Sporobolus airoides*) Herbaceous Vegetation (CEGL002042), which, in Nebraska, is called 'western alkaline meadows' (Steinauer and Rolfsmeier 2000).

ELEMENT DISTRIBUTION

Range: This western wheatgrass saline prairie type is found in the northern Great Plains of the United States, extending from perhaps Montana south to Nebraska.

Nations: US

States/Provinces: MT?, ND:S?, NE:S3, SD:S?, WY:S3S4

ELEMENT SOURCES

Authors: J. Drake, mod. D. Faber-Langendoen, WCS **Confidence:** 2 **Identifier:** CEGL001580

References: Bourgeron and Engelking 1994, Driscoll et al. 1984, Hanson and Whitman 1938, Harner-White Consultants n.d., Hirsch 1985, Johnston 1987, Jones 1992b, NVS Corporation n.d., Steinauer and Rolfsmeier 2000, Stoecker-Keammerer Consultants n.d.(a), Stoecker-Keammerer Consultants n.d.(c), Western Resources Development Corporation n.d. (b), Western Resources Development Corporation n.d. (c)

CALAMAGROSTIS CANADENSIS SEASONALLY FLOODED HERBACEOUS ALLIANCE Bluejoint Seasonally Flooded Herbaceous Alliance

ALLIANCE CONCEPT

Summary: This alliance is found throughout the northern states of the United States, excluding the Great Plains states. It is a wide-ranging alliance with much variability in species composition and habitat. Stands of this alliance have a dense graminoid cover, generally over 1 m tall, with either a flat or tussocky microtopography. Tall shrubs may occupy as much as 25% cover. *Calamagrostis canadensis* is the characteristic dominant but can be associated with *Phalaris arundinacea* or a variety of Carices. Other associates include, in the Northeast, shrubs such as *Viburnum nudum*, *Alnus incana*, or *Alnus serrulata*, *Viburnum dentatum*, *Spiraea alba*, and graminoids such as *Agrostis gigantea* (= *Agrostis alba*). In the Midwest, typical associates include several Carices, such as *Carex stricta*, *Carex rostrata*, or *Carex lacustris*, and occasionally *Poa palustris* or *Glyceria grandis* (Harris et al. 1996). The ground layer can be a heavy mat of grass stems and leaves, with patches of bare soil present in wetter locations.

The habitat of this alliance is typically mineral soil or well-decomposed peat, usually held together by a dense root mat. Stands are found in floodplains of small streams, beaver meadows, and lakeshores. The hydrology is typically

seasonally flooded (Harris et al. 1996). In the southern Appalachians of Tennessee and Virginia, this vegetation occurs in depression meadows and occasionally in beaver ponds.

Environment: This is a very wide-ranging alliance, found from coast-to-coast of the conterminous United States. Stands are found in wet meadows, basins, moist forest openings, broad glaciated valleys, floodplains of small streams, silted-in beaver ponds, on alluvial benches, terraces, or point bars, and on lake- or pond-shores. If along streams, they are typically small and low-gradient, and if found in depressions or meadows, slopes are flat to gentle. The elevation range is large, from near sea level in the eastern part of its range to well over 3500 meters in the Rocky Mountains, where it occurs from mid-montane into lower alpine zones.

The hydrology is typically seasonally flooded (Harris et al. 1996), with spring flooding common. Soils commonly remain moist throughout the growing season. Parent materials include coarse-textured alluvium or sediments, or well-decomposed peat, usually held together by a dense root mat. Soil textures range from clay loam to sands, and sometimes are over subhorizons of coarse fragment-rich buried streambeds (Crowe and Clausnitzer 1997, Hansen et al. 1995). There is usually an organic surface horizon.

Vegetation: This alliance is found throughout the northern states of the United States, excluding the Great Plains states. Stands of this alliance have a dense graminoid cover, generally over 1 m tall, with either a flat or tussocky microtopography. Tall shrubs may occupy as much as 25% cover. *Calamagrostis canadensis* is the characteristic dominant, in some stands forming a near monoculture. It can also be associated with *Phalaris arundinacea* or a variety of *Carex* species. In the northeast of its range, other associates include shrubs such as *Viburnum nudum*, *Alnus incana*, or *Alnus serrulata*, *Viburnum dentatum*, *Spiraea alba* and graminoids such as *Agrostis gigantea* (= *Agrostis alba*). In the Midwest, typical associates include several *Carex* species, such as *Carex stricta*, *Carex rostrata*, or *Carex lacustris*, and occasionally *Poa palustris* or *Glyceria grandis* (Harris et al. 1996). The ground layer can be a heavy mat of grass stems and leaves, with patches of bare soil present in wetter locations.

In the Rocky Mountains, this alliance is characterized by a dense cover of *Calamagrostis canadensis*. One or more of several *Carex* species can be present, including *Carex aquatilis*, *Carex scopulorum*, or *Carex utriculata*. Other graminoids that may be abundant in some stands include *Deschampsia caespitosa*, *Scirpus microcarpus*, *Glyceria* spp., *Elymus glaucus*, and *Poa* spp. Forb cover is typically minor, but may include *Cardamine cordifolia*, *Senecio triangularis*, *Epilobium* spp., *Achillea millefolium*, *Heracleum maximum* (= *Heracleum lanatum*), *Ligusticum* spp., *Asteraceae* spp., *Mertensia ciliata*, or *Veronica* spp. Woody species are uncommon, although species of *Salix*, *Lonicera involucrata*, *Rubus idaeus*, or *Cornus sericea* may be present.

Dynamics: Prescribed burning of stands of this alliance may increase the cover of rhizomatous species, such as *Calamagrostis canadensis*, an aggressive invader of burned sites, while reducing the abundance of other associated species. However, with repeated burning, non-native, rhizomatous *Poa pratensis* may be favored. Burning should be postponed if livestock grazing is necessary in the area. This is because of the high palatability of young *Calamagrostis canadensis* shoots which revegetate burned sites (Hansen et al. 1995).

Calamagrostis canadensis and the associated *Carex* species are effective streambank stabilizers due to their rhizomatous growth habit. Many *Carex* species tend to form a dense, thick sod highly resistant to erosion. *Deschampsia caespitosa*, another associated species, is not an effective streambank stabilizer due to its weak, fibrous root system (Hansen et al. 1995).

Calamagrostis canadensis is an aggressive invader of recently burned sites. In the Rocky Mountains, *Calamagrostis canadensis* meadows appear to be long-lived, mid-seral vegetation types. In Utah and Colorado, stands of this alliance often occur adjacent to *Pinus contorta*-dominated communities. When there is tree mortality due to bark beetle infestations, the water table rises as a result of less evapotranspiration. Increased available soil moisture allows for the expansion of *Calamagrostis canadensis*-dominated communities at the meadow/forest ecotone (Padgett et al. 1989).

Comments: Where *Calamagrostis* occurs in relatively pure stands or with a variety of forbs as codominants, stands can be assigned relatively confidently to this alliance. However, stands that are codominated by *Carex* species may overlap in composition with alliances such as V.A.5.N.k *Carex stricta* Seasonally Flooded Herbaceous Alliance (A.1397) or V.A.5.N.k *Carex lacustris* Seasonally Flooded Herbaceous Alliance (A.1367). These relationships require further study, as does the very broad range of the alliance, which currently stretches from California to Maine.

ALLIANCE SOURCES

Authors: MCS/ECS/SCS 6-96, MOD. M., RW, Midwest **Identifier:** A.1400

References: Cooper 1986a, Cooper and Cottrell 1990, Crowe and Clausnitzer 1997, Eggers and Reed 1987, Faber-Langendoen et al. 1996, Girard et al. 1997, Gysel 1960, Hansen et al. 1988b, Hansen et al. 1991, Hansen et al. 1995, Harris et al. 1996, Johnston 1987, Kittel et al. 1999a, Komarkova 1976, Komarkova 1986, Kovalchik 1993, MNNHP 1993, Mattson 1984, Mutel 1976, Mutel and Marr 1973, Mutz and Queiroz 1983, Padgett et al. 1989, Wilson 1969

CALAMAGROSTIS CANADENSIS WESTERN HERBACEOUS VEGETATION Bluejoint Western Herbaceous Vegetation

ELEMENT CONCEPT

Summary: This type occurs widely throughout mountainous areas of the western United States and probably into Canada. In Colorado, these grasslands are a relatively small, meadow association that occurs in broad glaciated valleys, openings in moist forests, silted-in beaver ponds, and narrow floodplains of lower montane canyons. It generally has few shrubs and fairly dense cover of grasses dominated by *Calamagrostis canadensis*.

Information on stands outside of Colorado will be added later.

Environment: These grasslands are a relatively small, meadow association that occurs in broad glaciated valleys, openings in moist forests, silted-in beaver ponds, and narrow floodplains of lower montane canyons.

Vegetation: The vegetation has few shrubs and contains a fairly dense cover of grasses dominated by *Calamagrostis canadensis*.

GRank & Reasons: G4 (00-04-26).

ELEMENT DISTRIBUTION

Range: This type occurs widely throughout mountainous areas of the western United States and probably into Canada.

Nations: CA US

States/Provinces: BC:S3S4, CA:S?, CO:S4, ID:S4, MT:S4, ND:S?, OR:S3S4, SD:S?, UT:S2S3, WA:S3S4, WY:S2

ELEMENT SOURCES

Authors: D. Faber-Langendoen, WCS **Confidence:** 2 **Identifier:** CEGLO01559

References: Bourgeron and Engelking 1994, Cooper 1986a, Cooper and Cottrell 1990, Crowe and Clausnitzer 1997, Driscoll et al. 1984, Gysel 1960, Hansen et al. 1988b, Hansen et al. 1991, Komarkova 1976, Kovalchik 1993, Mattson 1984, Mutel 1976, Mutel and Marr 1973, Mutz and Queiroz 1983, Padgett et al. 1989, Wilson 1969

CAREX (ROSTRATA, UTRICULATA) SEASONALLY FLOODED HERBACEOUS ALLIANCE (Swollen-beak Sedge, Beaked Sedge) Seasonally Flooded Herbaceous Alliance

ALLIANCE CONCEPT

Summary: This alliance is found in the upper midwestern United States and most western states as well as several Canadian provinces. Stands usually occur on wet mineral soil, muck, or shallow peat (<0.5 m). Standing water (generally stagnant) is present in the spring and after heavy rains, but the water table is generally below the surface for most of the growing season. This permits the breakdown of dead organic matter and the release of nutrients. Where stands are found along stream courses or lake margins, water levels may be more constant relative to stands in depressions or basins. This vegetation is dominated by tall wider-leaved sedges, with a mixture of forbs. Typical dominants include *Carex rostrata* or *Carex utriculata* (= *Carex rostrata* var. *utriculata*), as well as *Carex vesicaria*. Further study is needed to clarify the floristic characteristics of this alliance.

Environment: Vegetation types within this alliance are commonly wet meadow communities that occur around the edges of montane lakes and beaver ponds, along the margins of slow-moving reaches of streams and rivers, and in marshy swales and overflow channels on broad floodplains throughout the western United States. Elevations range from near sea level in California to 2900 m in Colorado. Occurrences are either adjacent to low-gradient streams in wide valley bottoms or associated with perennial seeps. The vegetation occurs in standing water or on sites that become relatively dry during the latter part of the growing season. Many sites are located in old beaver ponds that have filled with sediment. The surface may occasionally be mounded. Mounds result from a build-up of *Carex* spp. sod and downcutting of small channels by overland flow during spring runoff (Hansen et al. 1995).

A wide range of soils are associated with this alliance. Histosols are most common and often have organic accumulations greater than 1 m thick. Mollisols and Entisols are also associated with this type. Soil texture varies widely from loamy clay to sandy loam. Mottling often occurs within a few centimeters of the surface. Water tables are typically at or above the soil surface throughout the growing season. Soil reaction is slightly acid to neutral (pH 6.5-7.0).

Communities are often part of a wetland mosaic, with *Salix monticola*, *Salix drummondiana*, and *Salix geyeriana* shrublands. Communities also occur adjacent to and intergrade with *Carex aquatilis* or *Eleocharis palustris* meadows. *Populus angustifolia* and *Picea pungens* riparian forests occur on adjacent stream terraces in narrower valleys. *Abies lasiocarpa* - *Picea engelmannii* forests and *Populus tremuloides* woodlands occur on adjacent hillslopes at higher elevations; *Pinus ponderosa* and *Populus tremuloides* forests and *Quercus gambelii* shrublands occur at lower elevations (Kittel et al. 1999).

Vegetation: Vegetation types within this alliance are classified as seasonally flooded temperate grasslands. The vegetation is often characterized by nearly pure stands of *Carex utriculata* (20-98%). Other *Carex* species present include *Carex aquatilis*, *Carex vesicaria*, *Carex lenticularis*, *Carex atherodes*, and *Carex microptera*. Other graminoid species present are *Juncus*

balticus, *Deschampsia caespitosa*, *Glyceria striata*, and *Calamagrostis canadensis*. Forb cover ranges from 0-40%. Species include *Epilobium ciliatum*, *Polygonum amphibium*, *Comarum palustre* (= *Potentilla palustris*), and *Ranunculus gmelinii*. The layer of fern allies is typically dominated by either *Equisetum fluviatile* or *Equisetum arvense* with percent cover up to 80%. Willow carrs are often adjacent, and a few scattered willows can occur within a *Carex utriculata* stand, such as *Salix monticola*, *Salix drummondiana*, *Salix geyeriana*, or *Salix planifolia*.

Dynamics: *Carex utriculata* vegetation types occur on the wettest sites of the riparian or wetland area, such as low-lying swales, and shallow margins of lakes and ponds, often in standing water. The community is early seral and is known to invade margins of newly formed beaver ponds, as well as the freshly exposed silt beds of drained beaver ponds (Padgett et al. 1989). With time, these types will grade into *Carex aquatilis* and *Calamagrostis canadensis* types. *Calamagrostis canadensis* dominates the driest sites with the lowest water tables and colonizes drying stands of *Carex utriculata* and *Carex aquatilis* (Cooper 1986a).

Successional shifts in species composition is often initiated by a change in the physical environment of the riparian area. Flooding events result in sediments deposited on the floodplain, raising the surface higher above the water table (Cooper 1986a). As aggradation, or build up, of the floodplain proceeds, the site becomes drier and the dominant graminoid cover changes.

Abandoned beaver ponds also go through a similar succession. With time, ponds fill in with silt, and *Carex utriculata* establishes on the new, saturated substrate. As the site becomes firm and raised above the old pond level, *Carex aquatilis* and *Calamagrostis canadensis* become established in the undergrowth. Depending on site characteristics, various willow species may become established in the overstory as well, creating the *Salix monticola* / *Carex utriculata* Shrubland (CEGL002657) and the *Salix geyeriana* / *Calamagrostis canadensis* Shrubland (CEGL001205), for example.

Distance from the stream channel can also differentiate the graminoid spatially within the riparian mosaic. *Carex utriculata* commonly occurs at the stream channel edge where the water table is close to or at the surface. As the floodplain surface becomes higher with increased distance from the channel edge, the ground becomes slightly less saturated and shifts to mesic meadows of *Carex aquatilis*, or on higher surfaces, to slightly drier meadows of *Calamagrostis canadensis* (Kittel et al. 1999).

Comments: This alliance is currently found in two disjunct regions, the upper Midwest and the northwestern United States. Species nomenclature is a problem in this alliance. In Gleason and Cronquist (1991), *Carex rostrata* is circumboreal and only occurs in the U.S. in northern Michigan and northern Minnesota, whereas *Carex utriculata*, also circumboreal, extends southward to Delaware, Indiana, Nebraska, New Mexico, and California. As such, *Carex utriculata* may be the only typical component of this alliance in Midwest sedge meadows. However, Ownbey and Morley (1991) referred all material in Minnesota to *Carex rostrata* var. *utriculata*, and Voss (1972) only recognized *Carex rostrata* in Michigan. Kartesz (1999) recognizes both *Carex rostrata* and *Carex utriculata* as distinct species. Until the distinction between these two species is more clearly resolved they are kept together in the same alliance.

ALLIANCE SOURCES

Authors: D. CULVER, West **Identifier:** A.1403

References: Andrews 1983, Baker 1983a, Benedict 1983, Brown 1982, Cooper 1986a, Cronquist et al. 1977, Faber-Langendoen et al. 1996, Franklin and Dyrness 1973, Gleason and Cronquist 1991, Hansen et al. 1988b, Hansen et al. 1991, Hansen et al. 1995, Hermann 1970, Hess and Wasser 1982, Johnston 1987, Kartesz 1994a, Kartesz 1999, Kearney and Peebles 1969, Kerr and Henderson 1979, Kettler and McMullen 1996, Kittel and Lederer 1993, Kittel et al. 1994, Kittel et al. 1995, Kittel et al. 1996, Kittel et al. 1999a, Kovalchik 1987, Kovalchik 1993, Looman 1982, MNNHP 1993, Mattson 1984, Mutel 1973, Mutel 1976, Mutel and Marr 1973, Mutz and Graham 1982, Mutz and Queiroz 1983, Nachlinger 1985, Norton et al. 1981, Ownbey and Morley 1991, Padgett 1982, Padgett et al. 1988b, Padgett et al. 1989, Ramaley 1919a, Ramaley and Robbins 1909, Sawyer and Keeler-Wolf 1995, Schlatterer 1972, Seyer 1979, Tuhy 1981, Tuhy and Jensen 1982, Voss 1972, Youngblood et al. 1985a, Youngblood et al. 1985b

CAREX UTRICULATA HERBACEOUS VEGETATION Beaked Sedge Herbaceous Vegetation

ELEMENT CONCEPT

Summary: This wetland association is found throughout much of the western U.S. Stands occur in montane and subalpine areas around the edges of lakes and beaver ponds, along the margins of slow-moving reaches of streams and rivers, and in marshy swales and overflow channels on broad floodplains. Sites are flat to undulating, often with a hummocky microtopography. The water table is usually near the surface for most of the growing season. There are a wide variety of soil types for this association. The vegetation is characterized by a moderately dense to dense perennial graminoid layer dominated or codominated by *Carex utriculata* (20-99% cover). Stands often appear to be nearly pure *Carex utriculata*, but a variety of other graminoid species may be present as well. Other *Carex* species present include *Carex lenticularis*, *Carex aquatilis*, and *Carex microptera*, but usually with low cover. Other graminoid species that may be present include *Calamagrostis canadensis*, *Glyceria striata*, and *Juncus balticus*. The sparse forb cover can include *Geum macrophyllum*, *Mentha arvensis*, and *Mimulus guttatus*. Scattered *Salix* spp. shrubs may be present because these riparian shrublands are

often adjacent. *Salix* species vary depending on elevation and geography. It is distinguished from *Carex aquatilis* - *Carex utriculata* Herbaceous Vegetation (CEGL001803) by the dominance of *Carex utriculata*. *Carex aquatilis*, if present, is not more than 1/3 of the total cover.

Environment: This wetland association is found throughout much of the western U.S. Elevation ranges from 1060-2950 m (3500-9680 feet). Stands occur in montane and subalpine areas around the edges of lakes and beaver ponds, along the margins of slow-moving reaches of streams and rivers, and in marshy swales and overflow channels on broad floodplains (Kittel et al. 1999). Sites are flat to undulating, often with a hummocky microtopography (Kovalchik 1993). The water table is usually near the surface for most of the growing season. There are a wide variety of soil types for this association ranging from saturated organics or fine silty clays to clays over cobbles and alluvium to fine-loamy and sandy-skeletal. Mottling and gleying often occur near the surface because of the high water table.

Vegetation: This plant association is characterized by a moderately dense to dense perennial graminoid layer dominated or codominated by *Carex utriculata* (20-99% cover). Stands often appear to be nearly pure *Carex utriculata*, but a variety of other graminoid species may be present as well. Other *Carex* species present include *Carex lenticularis*, *Carex microptera*, *Carex nebrascensis*, and *Carex scopulorum*, but usually with low cover. Other graminoid species that may be present include *Calamagrostis canadensis*, *Deschampsia caespitosa*, *Glyceria striata*, and *Juncus balticus*. Sparse forb cover may include *Epilobium* spp., *Geum macrophyllum*, *Mentha arvensis*, *Mimulus guttatus*, and *Polemonium occidentale*. Scattered *Salix* spp. shrubs may be present because these riparian shrublands are often adjacent. *Salix* species vary depending on elevation and geography. *Salix monticola*, *Salix drummondiana*, *Salix geyeriana*, *Salix planifolia*, and *Salix exigua* are common species.

Dynamics: *Carex utriculata* is a widespread species that colonizes recently formed pond edges and seasonally flooded areas near streams. Once established it is long-lived and will dominate sites unless disturbed with changes in site hydrology. Soil development (over time) may decrease soil moisture and allow other species to replace it (Manning and Padgett 1995).

Similar Associations:

- *Carex aquatilis* - *Carex utriculata* Herbaceous Vegetation (CEGL001803)

GRank & Reasons: G5 (96-02-01).

Comments: *Carex rostrata* var. *utriculata* (Boott) Bailey was recognized as a distinct species from *Carex rostrata* Stokes and named *Carex utriculata* Boott (Kartesz 1999). This taxonomic change has led to confusion in some of the earlier vegetation classification literature where no distinction was made between the subspecies. *Carex utriculata* Herbaceous Vegetation (CEGL001562) is known only from the western U.S., and for now, *Carex rostrata* communities are known only from the midwestern U.S. and Canada. According to Kartesz (1999), *Carex rostrata* is reported from most of Canada, some Great Lakes states and Montana, Idaho, and Washington in the western U.S. There is significant overlap in the species ranges, and additional survey work is needed to help clarify this.

ELEMENT DISTRIBUTION

Range: This wetland association is found at montane and subalpine elevations throughout much of the western U.S.

Nations: US

States/Provinces: AZ?, CA:S4, CO:S4, ID:S4, MT:S5, NM:S3, NV:S?, OR:S4, UT:S3S4, WA:S3S4, WY:S3

ELEMENT SOURCES

Authors: K.A. Schulz, WCS **Confidence:** 1 **Identifier:** CEGL001562

References: Andrews 1983, Baker 1983a, Benedict 1983, Bourgeron and Engelking 1994, Driscoll et al. 1984, Franklin and Dyrness 1973, Hall and Hansen 1997, Halpern 1986, Hansen et al. 1988b, Hansen et al. 1991, Hansen et al. 1995, Hess and Wasser 1982, Kartesz 1999, Kerr and Henderson 1979, Kettler and McMullen 1996, Kittel and Lederer 1993, Kittel et al. 1994, Kittel et al. 1995, Kittel et al. 1996, Kittel et al. 1999a, Kovalchik 1987, Kovalchik 1993, Looman 1982, Manning and Padgett 1995, Mattson 1984, Mutel 1973, Mutel 1976, Mutel and Marr 1973, Mutz and Graham 1982, Mutz and Queiroz 1983, Nachlinger 1985, Norton et al. 1981, Padgett 1982, Padgett et al. 1988b, Padgett et al. 1989, Ramaley 1919a, Ramaley and Robbins 1909, Schlatterer 1972, Seyer 1979, Taylor 1984, Tuhy 1981, Tuhy and Jensen 1982, Youngblood et al. 1985a, Youngblood et al. 1985b

CAREX AQUATILIS SEASONALLY FLOODED HERBACEOUS ALLIANCE Aquatic Sedge
Seasonally Flooded Herbaceous Alliance

ALLIANCE CONCEPT

Summary: This alliance is found from the western Great Lakes to the western United States. This description is based on the one community that occurs in the Midwest. Stands typically occur in depressions or around ponds or lakes, although they sometimes can be found adjacent to streams or rivers. The sites on which it develops are flooded for some time during the growing season in most years. *Carex aquatilis*-dominated stands were found in the northern Great Plains on mostly mineral soils in fresh or slightly saline shallow marshes. The vegetation is dominated by graminoids approximately 0.4-0.7 m tall. *Carex* spp. predominate, especially *Carex aquatilis*, and often include *Carex rostrata*, *Carex lacustris*, and *Carex stricta*.

Eleocharis palustris, *Polygonum amphibium*, *Scirpus* spp., and *Typha* spp. may all be found in stands of this alliance. *Scolochloa festuacea* may be found in drier stands. Woody species are rare. If present, they are shrubs such as *Salix* spp.

Environment: Vegetation types within this common, widespread alliance occur as large meadows in high montane valleys or as narrow strips bordering ponds and streams at lower elevations. Elevations range from near sea level in California to 3500 m in Colorado. Stands occur in a variety of landforms, but the largest expanses occur in broad, low-gradient valleys where large snowmelt-fed swales and slopes dominate the landscape. Stands also occur in fine sediments at the margins of lakes, silted-in beaver ponds, or depressions left by migrating stream channels. Looman (1981a, 1982) found *Carex aquatilis*-dominated stands in the northern Great Plains on mostly mineral soils in fresh or slightly saline shallow marshes.

Soils are typically Histosols. Mollisols are less frequently associated with this alliance. Soil texture varies from clay to sandy loam. Water tables are at or near the soil surface throughout the year. Soil pH ranges from 6.0-7.0 (Hansen et al. 1995).

Vegetation in the alliance usually occurs in a mosaic of riparian plant associations, such as *Salix planifolia*, *Salix wolfii*, and *Salix monticola* - *Salix geyeriana* shrublands and *Carex utriculata* wetlands in adjacent standing water. *Abies lasiocarpa* - *Picea engelmannii* forests and alpine fell-fields occur on adjacent hillslopes at higher elevations (Kittel et al. 1999).

Vegetation: Vegetation types within this alliance are classified as seasonally flooded temperate grasslands. Vegetation types are characterized by a dense, rhizomatous meadow of *Carex aquatilis* (50-80%), usually accompanied a few other graminoids species such as *Calamagrostis canadensis* or *Deschampsia caespitosa*. *Carex utriculata* is often present with 10-30% cover. A few forbs are commonly present, with percent cover ranging from 10-25%. Forb species include *Pedicularis groenlandica*, *Caltha leptosepala*, *Symphyotrichum foliaceum* (= *Aster foliaceus*), *Urtica dioica*, and *Epilobium ciliatum*. The fern layer is typically dominated by *Equisetum variegatum* with percent cover up to 40%. Willow carrs are often adjacent. A few scattered willows occur within the *Carex aquatilis* stand, such as *Salix monticola*, *Salix drummondiana*, *Salix geyeriana*, and *Salix planifolia*. In the subalpine stands *Abies lasiocarpa* and *Picea engelmannii* occur with up to 10% cover (Kittel et al. 1999, Hansen et al. 1995).

Dynamics: Presence of *Carex utriculata* may indicate the site has progressed from the more wet *Carex utriculata* type to the current more mesic conditions, and may become dominated by *Salix planifolia* or *Salix wolfii* (Youngblood et al. 1985b). Wilson (1969) reports that *Carex aquatilis* associations trap sediment from overbank flows which forms a clay pan, eventually raising the water table. This process drives retrogressive succession and a plant association dominated by *Carex utriculata* often takes over on these sites (Wilson 1969).

Comments: This alliance is not well-defined. It is similar to several other wet *Carex* spp.-dominated alliances, including *Carex aquatilis* Saturated Herbaceous Alliance (A.3526) in the West and Canada. Diagnostic species lists and environmental characteristics have not been well-defined.

Carex aquatilis var. *dives* is a synonym for *Carex sitchensis* (Kartesz 1999). This alliance occurs mainly west of the Cascade Mountains in similar habitats as *Carex aquatilis*.

ALLIANCE SOURCES

Authors: D. CULVER, West **Identifier:** A.1404

References: Andrews 1983, Baker 1983a, Baker 1983c, Baker 1984a, Baker and Kennedy 1985, Bierly 1972, Briggs and MacMahon 1983, Bunin 1975c, Cox 1933, Cronquist et al. 1977, Faber-Langendoen et al. 1996, Giese 1975, Hall 1971, Hansen et al. 1988b, Hansen et al. 1991, Hansen et al. 1995, Hermann 1970, Hess 1981, Hess and Wasser 1982, Hickman 1993, Johnson 1932a, Johnson 1932b, Johnson 1936, Johnson 1939, Johnston 1987, Kartesz 1999, Kearney and Peebles 1969, Kettler and McMullen 1996, Kittel and Lederer 1993, Kittel et al. 1994, Kittel et al. 1995, Kittel et al. 1996, Kittel et al. 1999a, Komarkova 1976, Komarkova 1986, Kovalchik 1987, Kovalchik 1993, Langenheim 1962, Lewis 1970, Looman 1981a, Looman 1982, Mattson 1984, Mutel 1976, Norton et al. 1981, Padgett and Manning 1988, Padgett et al. 1988b, Padgett et al. 1989, Ramaley 1919a, Ramaley 1920, Robbins 1918, Sanderson and Kettler 1996, Terwilliger et al. 1979a, Tuhy 1981, Tuhy and Jensen 1982, Wilson 1969, Youngblood et al. 1985a, Youngblood et al. 1985b

CAREX AQUATILIS HERBACEOUS VEGETATION Aquatic Sedge Herbaceous Vegetation

ELEMENT CONCEPT

Summary: This common, widespread herbaceous vegetation occurs as large, mesic meadows in high montane valleys or as narrow strips bordering ponds and streams at lower elevations throughout the western U.S. It occurs in a variety of environmental settings in the montane and subalpine zones. Some of the largest expanses occur in broad, low-gradient valleys where large snowmelt-fed swales and slopes dominate the landscape. It can also grow in fine sediments at the margins of lakes and beaver ponds. Presence of *Carex aquatilis* typically indicates wet soils with high organic matter or histic epipedons. A clear dominance by *Carex aquatilis* and low cover of *Carex utriculata* or *Pedicularis groenlandica* sets this plant association apart from closely related types.

Environment: This plant association occurs in a variety of valley types, but the largest expanses occur in broad, low-gradient valleys where large snowmelt-fed swales and slopes dominate the landscape. It can also grow in fine sediments at

the margins of lakes and beaver ponds. Presence of at least 25% cover of *Carex aquatilis* typically indicates wet soils with high organic matter or histic epipedons.

Vegetation: This plant association is characterized by a dense rhizomatous meadow of *Carex aquatilis* (10-80% cover), usually accompanied by a few other graminoids species such as *Calamagrostis canadensis* (1-40%) or *Deschampsia caespitosa* (1-16%). *Eleocharis quinqueflora* can be abundant on organic substrates (1-49% cover) at high elevations. *Carex utriculata* (1-20% cover) may be present. When present, *Carex utriculata* is usually not more than one-third the cover of *Carex aquatilis* cover. If it is more than that, the stand may be classified as *Carex aquatilis* - *Carex utriculata* Herbaceous Vegetation (CEGL001803) or *Carex utriculata* Herbaceous Vegetation (CEGL001562). Forbs are often present, although sometimes inconspicuous (generally <10%, but can be as high as 40%). Species include *Epilobium* spp., *Pedicularis groenlandica*, *Caltha leptosepala*, *Cardamine cordifolia*, and *Mertensia ciliata*.

Dynamics: Overgrazing by livestock can dry the site, increase non-native grass cover, and reduce the vigor of root structure. The wet and often saturated soils of this plant association are also vulnerable to compaction by livestock and heavy equipment. In order to maintain productivity and vigor of the plants and prevent damage to the soils, livestock grazing should be deferred until soils dry (Hansen et al. 1995).

Deferred and rest rotation grazing systems are recommended for maintaining the vigor and productivity of this plant association. Rest periods are recommended in order to provide time for plant establishment. Late summer and fall grazing is not recommended because if there are adjacent willows, they are vulnerable to pruning damage due to limited regrowth before the end of the growing season (Hansen et al. 1995, Kovalchik and Elmore 1992).

Beaver activity in the vicinity of this plant association is important for maintaining the health of the riparian ecosystem. Beaver dams aid in controlling channel downcutting, streambank erosion, and downstream movement of sediment. Beaver dams raise the water table and provide water for hydrophytic plants including willows and sedges. The trapping of sediment behind beaver dams, along with plant reproduction, raises the channel bed and creates a wetland environment. Land managers should consider maintaining beaver activity in an area versus their removal (Hansen et al. 1995).

Burning of this plant association temporarily increases the productivity of *Carex utriculata* and *Carex aquatilis*. However, livestock grazing needs to be eliminated for the year prior to burning and for at least 2-3 years after burning. This is necessary in order to keep livestock from damaging young, palatable regrowth and to allow for root reserve build up. Prescribed burning is also an effective method of rejuvenating decadent clumps of willows. The willow species in this plant association vigorously sprout following quick, hot fires. Slow-burning fires can actually damage the plants (Hansen et al. 1995).

Presence of *Carex utriculata* may indicate the site has progressed from the more wet *Carex utriculata* community to the current less mesic conditions, and may become dominated by *Salix planifolia* or *Salix wolfii* (Youngblood et al. 1985a). Wilson (1969) reports that *Carex aquatilis* associations trap sediment from overbank flows which forms a clay pan, eventually raising the water table. This process drives retrogressive succession, and a plant association dominated by *Carex utriculata* takes over on these sites (Wilson 1969).

GRank & Reasons: G5 (96-02-01).

Comments: *Carex aquatilis* Herbaceous Vegetation (CEGL001802) is distinguished from *Carex aquatilis* - *Carex utriculata* Herbaceous Vegetation (CEGL001803) and *Carex aquatilis* - *Pedicularis groenlandica* Herbaceous Vegetation (CEGL001804) by the dominance of *Carex aquatilis*. If *Carex utriculata* is present, it is no more than 1/3 of the total cover.

ELEMENT DISTRIBUTION

Range: This association is common and located throughout the western U.S. and Canada.

Nations: US

States/Provinces: AZ?, CA:S3, CO:S4, ID:S4, MT:S4, NM:S4, NV:S?, OR:S4, UT:S3?, WA:S3, WY:S3

ELEMENT SOURCES

Authors: G. Kittel, WCS **Confidence:** 1 **Identifier:** CEGL001802

References: Baker 1983c, Baker 1984a, Baker and Kennedy 1985, Bierly 1972, Bourgeron and Engelking 1994, Briggs and MacMahon 1983, Bunin 1975c, Cox 1933, Crowe and Clausnitzer 1997, Driscoll et al. 1984, Giese 1975, Hall 1971, Hansen et al. 1988b, Hansen et al. 1991, Hansen et al. 1995, Hess and Wasser 1982, Johnson 1932a, Johnson 1932b, Johnson 1936, Johnson 1939, Kettler and McMullen 1996, Kittel and Lederer 1993, Kittel et al. 1995, Kittel et al. 1996, Komarkova 1976, Kovalchik 1993, Kovalchik and Elmore 1992, Lewis 1970, Manning and Padgett 1995, Mattson 1984, Norton et al. 1981, Padgett and Manning 1988, Padgett et al. 1988b, Padgett et al. 1989, Ramaley 1919a, Ramaley 1920, Robbins 1918, Sanderson and Kettler 1996, Terwilliger et al. 1979a, Tuhy 1981, Tuhy and Jensen 1982, Wilson 1969, Youngblood et al. 1985a, Youngblood et al. 1985b

CAREX NEBRASCENSIS SEASONALLY FLOODED HERBACEOUS ALLIANCE Nebraska Sedge Seasonally Flooded Herbaceous Alliance

ALLIANCE CONCEPT

Summary: Vegetation types within this seasonally flooded, temperate or subpolar grassland alliance occur on saturated soils of flat floodplains bordering ponds or pools adjacent to stream channels. Stands also occur on flat marshy areas surrounding springs or wet meadows. Elevations range from sea level in California to 2400 m in Colorado. The alluvial soils are heavy clays and silty clay loams with high organic matter content. Soils are alkaline in some sites. Anoxic conditions often occur within 20 cm of the surface either in the form of a gleyed layer or abundant mottling. Soils often remain saturated throughout the summer, but water tables occasionally drop below 1 m of the soil surface by the end of the growing season. This alliance is dominated by 30-98% cover of *Carex nebrascensis*. *Carex nebrascensis* typically occurs on sites where water flows over the surface but does not pond. Other graminoids include *Eleocharis palustris*, *Carex praegracilis*, *Catabrosa aquatica*, *Calamagrostis stricta*, *Triglochin maritima*, and *Schoenoplectus pungens* (= *Scirpus pungens*). Forb cover is generally low. Adjacent riparian vegetation includes *Populus angustifolia* and *Populus balsamifera* ssp. *trichocarpa* (= *Populus trichocarpa*) forests, *Salix exigua*, *Salix lucida*, and *Salix boothii* shrublands, and *Carex praegracilis*, *Carex utriculata*, and *Schoenoplectus tabernaemontani*? (= *Scirpus lacustris*) meadows. *Pinus edulis* - *Juniperus* spp. and *Quercus gambelii* woodlands, *Sarcobatus vermiculatus* and *Artemisia tridentata* shrublands, and *Bouteloua gracilis* shortgrass prairies occur on adjacent hillslopes.

Environment: Vegetation types within this alliance occur on saturated soils of flat floodplains bordering ponds or pools adjacent to stream channels. Stands also occur on flat marshy areas surrounding springs or wet meadows. Elevations range from sea level in California to 2400 m in Colorado.

The alluvial soils are heavy clays and silty clay loams with high organic matter content. Soils are alkaline in some sites. Anoxic conditions often occur within 20 cm of the surface either in the form of a gleyed layer or abundant mottling. Soils often remain saturated throughout the summer, but water tables occasionally drop below 1 m of the soil surface by the end of the growing season. *Carex nebrascensis* typically occurs on sites where water flows over the surface but does not pond (Ratliff and Westfall 1988).

Adjacent riparian vegetation includes *Populus angustifolia* and *Populus balsamifera* ssp. *trichocarpa* forests, *Salix exigua*, *Salix lucida*, and *Salix boothii* shrublands, and *Carex praegracilis*, *Carex utriculata*, and *Schoenoplectus tabernaemontani* meadows. *Pinus edulis* - *Juniperus* spp. and *Quercus gambelii* woodlands, *Sarcobatus vermiculatus* and *Artemisia tridentata* shrublands, and *Bouteloua gracilis* shortgrass prairies occur on adjacent hillslopes.

Vegetation: Vegetation types within this alliance are classified as seasonally flooded temperate or subpolar grasslands. This alliance is dominated by 30-98% cover of *Carex nebrascensis*. Other graminoids include *Eleocharis palustris*, *Carex praegracilis*, *Catabrosa aquatica*, *Calamagrostis stricta*, *Triglochin maritima*, and *Schoenoplectus pungens* (= *Scirpus pungens*). Forb cover is generally low.

Dynamics: In Montana, the *Carex nebrascensis* type is considered a grazing-disclimax. Under season-long grazing, *Carex nebrascensis* increases in abundance, replacing former dominant species (Hansen et al. 1995). However, under extreme grazing conditions and a resulting drop in the water table, *Juncus balticus* or *Poa pratensis* can eventually replace *Carex nebrascensis*. In Nevada, sites dominated by *Carex nebrascensis* are considered the Potential Natural Community (Manning and Padgett 1995), which appears to be the case in undisturbed stands in Colorado.

Unlike other moisture-loving species of sedges, *Carex nebrascensis* readily tolerates dry air and intense insolation, so long as its roots are wet (Cronquist et al. 1977).

ALLIANCE SOURCES

Authors: D. CULVER, West **Identifier:** A.1417

References: Baker 1982b, Cooper and Cottrell 1990, Cronquist et al. 1977, Durkin et al. 1994b, Durkin et al. 1995, Hall 1973, Hansen et al. 1988b, Hansen et al. 1991, Hansen et al. 1995, Hermann 1970, Johnston 1987, Jones and Walford 1995, Kearney and Peebles 1969, Kittel et al. 1994, Kittel et al. 1996, Kittel et al. 1999a, Kovalchik 1987, Manning and Padgett 1995, Martin and Hutchins 1980, Mutz and Queiroz 1983, Padgett and Manning 1988, Padgett et al. 1988b, Padgett et al. 1989, Ratliff and Westfall 1988, Youngblood et al. 1985a, Youngblood et al. 1985b

CAREX NEBRASCENSIS HERBACEOUS VEGETATION Nebraska Sedge Herbaceous Vegetation**ELEMENT CONCEPT**

Summary: These minor wetlands occur on the western Great Plains and throughout much of the western U.S. Elevation ranges from 1000-2800 m (3300-9200 feet). Stands form open meadows that occur along the margins of streambanks, flat floodplains, and lakes often forming a band along the alluvial terrace, or on marshy areas surrounding springs and below seeps on lower hillslopes. This association is often found on well-developed soil, but occurs on a wide variety of soil types that tend to be fine-textured alluvium, or clay to organic and are typically gleyed and mottled near the surface because of the high water table most of the growing season. The vegetation is characterized by a moderately dense to dense perennial graminoid layer dominated or codominated by *Carex nebrascensis*. Other graminoid species may be present such as *Carex praegracilis*, *Calamagrostis stricta*, *Deschampsia caespitosa*, *Eleocharis palustris*, *Glyceria striata*, *Juncus balticus*,

Schoenoplectus pungens (= *Scirpus pungens*), or *Triglochin maritima*. Forb cover is generally low, but can be high in moist locations.

Environment: This wetland plant association occurs on the western Great Plains and throughout much of the western U.S. Elevation ranges from 1000-2800 m (3300-9200 feet). Stands form open meadows that occur along the margins of streambanks, flat floodplains, and lakes often forming a band along the alluvial terrace. Stands have also been sampled from marshy areas surrounding springs and below seeps on lower hillslopes. This association is often found on well-developed soil, but occurs on a wide variety of soil types ranging from saturated organics to Mollisols to Entisols. Soils tend to be fine-textured alluvium, ranging from sandy, silty loam, clay loam, or clay to organic and are typically gleyed and mottled near the surface because of the high water table most of the growing season.

Vegetation: These wetlands are characterized by a moderately dense to dense perennial graminoid layer dominated or codominated by *Carex nebrascensis* (25-99% cover), that generally forms small- to medium-sized meadows. Stands often are nearly pure *Carex nebrascensis*, but a variety of other graminoid species may be present such as *Carex praegracilis*, *Calamagrostis stricta*, *Calamagrostis canadensis*, *Deschampsia caespitosa*, *Eleocharis palustris*, *Glyceria striata*, *Juncus balticus*, *Schoenoplectus pungens* (= *Scirpus pungens*), or *Triglochin maritima*. Forb cover is generally low, but can be high in moist locations. Common forbs include *Eurybia integrifolia* (= *Aster integrifolius*), *Geum macrophyllum*, *Mentha arvensis*, *Mimulus glabratus*, *Heracleum maximum*, and *Ranunculus cymbalaria*. Introduced species *Poa pratensis*, *Poa palustris*, *Cirsium arvense*, and *Melilotus officinalis* may also be common.

In Nebraska, common species include *Agrostis stolonifera*, *Carex hystericina*, *Carex pellita* (= *Carex lanuginosa*), *Eleocharis erythropoda*, *Equisetum* spp., *Juncus balticus*, *Schoenoplectus pungens* (= *Scirpus pungens*), and *Triglochin* spp. (Steinauer and Rolfsmeier 2000).

Dynamics: In Montana, the *Carex nebrascensis* Community Type is considered a grazing-disclimax. Under season-long grazing, *Carex nebrascensis* increases in abundance, replacing former dominant species (Hansen et al. 1995). However, under extreme grazing conditions and a resulting drop in the water table, *Juncus balticus* or *Poa pratensis* can eventually replace *Carex nebrascensis*. In Nevada, sites dominated by *Carex nebrascensis* are considered the Potential Natural Community (Manning and Padgett 1995), which appears to be the case in undisturbed stands in Colorado.

GRank & Reasons: G4 (96-02-01). This type is widely distributed, but many examples have been heavily grazed by cattle, lowering their floristic quality.

Comments: In the Black Hills, classification of stands was problematic due to identification problems with *Carex nebrascensis* and *Carex aquatilis*. The two are difficult to distinguish based on available keys and written descriptions (Marriott and Faber-Langendoen 2000).

ELEMENT DISTRIBUTION

Range: This sedge meadow type is widely distributed from the western Great Plains into the western mountains of the United States, ranging from South Dakota and Montana to possibly as far west as Washington, south to California and east to New Mexico.

Nations: US

States/Provinces: AZ:S2, CA:S3, CO:S3, ID:S3, MT:S4, NE:S2, NM?, NV:SR, OR:S3?, SD:S?, UT:S3?, WA?, WY:S3

ELEMENT SOURCES

Authors: J. Drake, mod. D. Faber-Langendoen, mod. K.A. Schulz, WCS **Confidence:** 1 **Identifier:** CEGLO01813

References: Baker 1982b, Bourgeron and Engelking 1994, Cooper and Cottrell 1990, Driscoll et al. 1984, Hall 1973, Hall and Hansen 1997, Hansen et al. 1988b, Hansen et al. 1991, Hansen et al. 1995, Jones 1992b, Jones and Walford 1995, Kittel et al. 1994, Kittel et al. 1996, Kittel et al. 1999a, Kovalchik 1987, Manning and Padgett 1995, Marriott and Faber-Langendoen 2000, Mutz and Queiroz 1983, Padgett et al. 1988b, Padgett et al. 1989, Steinauer and Rolfsmeier 2000, Youngblood et al. 1985a, Youngblood et al. 1985b

CAREX PRAEGRACILIS SEASONALLY FLOODED HERBACEOUS ALLIANCE Clustered Field Sedge Seasonally Flooded Herbaceous Alliance

ALLIANCE CONCEPT

Summary: Vegetation types within this seasonally flooded, temperate or subpolar grassland alliance occur in wet meadows and moist swales and adjacent to seeps, springs, and stream channels in the mountains and shortgrass prairie. Elevations range from 1300-2400 m. Sites range from wet meadows that are often alkaline to peat-accumulating fens. The majority of the sites are relatively flat (1-4% slope). Soils are variable. Some sites have fairly deep soils that range from heavy clays to sandy clay loams with mottling. Sites near seeps or springs have peaty soils, up to 60 cm deep. Surface water is typically present for extended periods well into the growing season. The water table is usually near the soil surface. *Carex praegracilis* dominates the graminoid stratum with up to 100% cover. Stands on drier sites form narrow bands with 25-30% cover. Other graminoid species include *Calamagrostis stricta*, *Carex aquatilis*, *Carex simulata*, *Carex utriculata*, *Deschampsia caespitosa*, *Eleocharis palustris*, and *Juncus balticus*. The forb stratum is present with up to 30% cover; species include

Cicuta douglasii and *Senecio hydrophilus*. Adjacent vegetation includes patches of *Carex nebrascensis* and *Pascopyrum smithii* (= *Agropyron smithii*) on the prairie and *Salix* spp. shrublands in the mountains.

Environment: Vegetation types within this alliance occur in wet meadows and moist swales and adjacent to seeps, springs, and stream channels in the mountains and shortgrass prairie. Elevations range from 1300-2400 m. Sites range from wet meadows that are often alkaline to peat-accumulating fens. The majority of the sites are relatively flat (1-4% slope).

Soils are variable. Some sites have fairly deep soils that range from heavy clays to sandy clay loams with mottling. Sites near seeps or springs have peaty soils, up to 60 cm deep. Surface water is typically present for extended periods well into the growing season. The water table is usually near the soil surface. Adjacent vegetation includes patches of *Carex nebrascensis* and *Pascopyrum smithii* on the prairie and *Salix* spp. shrublands in the mountains.

Vegetation: Vegetation types within this alliance are classified as seasonally flooded temperate or subpolar grasslands. *Carex praegracilis* dominates the graminoid stratum with up to 100% cover. Stands on drier sites form narrow bands with 25-30% cover. (Kittel et al. 1999). Other graminoid species include *Calamagrostis stricta*, *Carex aquatilis*, *Carex simulata*, *Carex utriculata*, *Deschampsia caespitosa*, *Eleocharis palustris*, and *Juncus balticus*. The forb stratum is present with up to 30% cover; species include *Cicuta douglasii* and *Senecio hydrophilus*.

ALLIANCE SOURCES

Authors: D. CULVER, West **Identifier:** A.1419

References: Brotherson and Barnes 1984, Cronquist et al. 1977, Culver and Sanderson 1997, Durkin et al. 1994b, Hansen et al. 1988b, Hermann 1970, Jones and Walford 1995, Kittel et al. 1997, Kittel et al. 1999a

CAREX PRAEGRACILIS HERBACEOUS VEGETATION Clustered Field Sedge Herbaceous Vegetation

ELEMENT CONCEPT

Summary: This plant association forms meadows in swales and along stream channels in the prairies of several western states (Montana, Idaho, Wyoming, Colorado) on both sides of the Continental Divide. In Montana it is found at elevations as low as 2000 feet. The association occurs along small, shallow streams, usually no more than 2-5 m (7-17 feet) wide, with little sinuosity, low gradient and little to no floodplain development. Soils are deep, ranging from heavy clays to sandy clay loams. Often the only vegetation type along small streams, it completely covers the ground in narrow bands following the streambed and dominated by *Carex praegracilis* (20-40% cover), *Eleocharis palustris*, and *Equisetum laevigatum*. Alternatively, it can occur in patches within a mosaic of monotypic stands of wet meadow graminoid species including *Juncus balticus*, *Carex nebrascensis*, *Carex pellita* (= *Carex lanuginosa*), and *Schoenoplectus pungens* (= *Scirpus pungens*). No shrubs or trees are present.

Similar Associations:

- *Carex praegracilis* - *Carex aquatilis* Herbaceous Vegetation (CEGL001821)

GRank & Reasons: G3G4 (01-02-05). This association is known from several western states, although few stands have been well-documented. Stands are small meadows in Colorado (1-20 acres), but it is known to form large meadows in southwestern Montana. Occurrences on federal lands are often in a degraded condition. The highest conditions exist on unprotected private lands. Soil compaction and compositional shifts from grazing and heavy recreational use are the greatest threats. The global rank was changed from G2 to G3G4 to reflect the wide distribution of the type as well as its apparent abundance in several states (Montana and Wyoming).

Comments: This association is known from several western states (MT, ID, WY, CO), although few stands have been well-documented. This type needs to be compared with *Carex praegracilis* - *Carex aquatilis* Herbaceous Vegetation (CEGL001821), as they are probably the same type.

ELEMENT DISTRIBUTION

Range: The plant association occurs in appropriate habitat across the Rocky Mountain and northern Great Basin states.

Nations: US

States/Provinces: CO:S2, ID:S2, MT:S3S4, WY:S3S4

ELEMENT SOURCES

Authors: R.J. Rondeau, mod. M.S. Reid, WCS **Confidence:** 2 **Identifier:** CEGL002660

References: Culver and Sanderson 1997, Hansen et al. 1995, Jones and Walford 1995, Kittel et al. 1997, Kittel et al. 1999a

CAREX SCOPULORUM SEASONALLY FLOODED HERBACEOUS ALLIANCE Holm's Rocky Mountain Sedge Seasonally Flooded Herbaceous Alliance

ALLIANCE CONCEPT

Summary: This alliance has been described from wet meadows, streambanks, and lakeshores in the mountains of Oregon, Nevada, Colorado and Montana, and likely occurs in similar habitats throughout the western U.S. Stands also occur in wet

areas in alpine tundra. Soils are generally poorly drained. Saturated soils retard plant decomposition and favor organic matter accumulation. Flooding during spring runoff is common, and water tables remain within the root zone throughout the summer. Vegetation within this alliance is characterized by an herbaceous layer dominated or codominated by *Carex scopulorum*. Many other graminoids may be present to common including *Agrostis humilis* (= *Agrostis thurberiana*), *Alopecurus alpinus*, *Carex phaeocephala*, *Carex jonesii*, *Carex illota*, *Carex nigricans*, *Deschampsia caespitosa*, and *Eleocharis quinqueflora* (= *Eleocharis pauciflora*). Forb cover may codominate the herbaceous layer. Characteristic species include *Caltha leptosepala*, *Mimulus primuloides*, *Ligusticum filicinum*, *Saxifraga odontoloma*, *Oreostemma alpigenum* (= *Aster alpigenus*), *Parnassia fimbriata*, *Dodecatheon jeffreyi*, *Pedicularis groenlandica*, and *Equisetum arvense*. Scattered shrubs are occasionally present, such as *Salix commutata*, *Salix planifolia*, and *Kalmia microphylla*. Diagnostic of this herbaceous alliance is the dominance or codominance of *Carex scopulorum* and the presence of surface water for extended periods during the growing season.

Environment: Vegetation types within this alliance occur in wet meadows and on streambanks and lakeshores in the mountains. Elevations range from 1650 m in the Cascade Mountains to 3900 m in Colorado. Stands are located in level to gently sloping (1-10%) marshy areas adjacent to streams or melting snow fields, often at the headwaters of creeks (Kittel et al. 1999). Stands occur in low-lying depressions in the alpine tundra where high levels of moisture collect from snow accumulation (Hess 1981) and in lower elevation meadows (Kovalchik 1987, Manning and Padgett 1995).

Soils are mineral with a high organic matter content. Soils are derived from alluvial and colluvial deposits of granitic, schist, and gneiss origins (Hess 1981). Soils are generally poorly drained. Saturated soils retard plant decomposition and favor organic matter accumulation. Flooding during spring runoff is common, and water tables remain within the root zone throughout the summer (Hansen et al. 1995). Standing water usually occupies sites until late into the summer. Soil are strongly acid, ranging from 4.8-5.4 pH (Hess 1981).

Carex aquatilis and *Eleocharis quinqueflora* meadows occur in adjacent lower swales, and *Deschampsia caespitosa* meadows occur on adjacent hummocks and toe slopes. *Salix planifolia* and *Salix brachycarpa* shrublands also occur in adjacent riparian areas. Alpine talus slopes and *Abies lasiocarpa* - *Picea engelmannii* forests occur on adjacent hillslopes.

Vegetation: Vegetation types within this alliance are classified as seasonally flooded, temperate or subpolar grasslands. *Carex scopulorum* dominates with 20-70% cover. Other graminoids include *Alopecurus alpinus* and *Carex phaeocephala* in Montana (Hansen et al. 1992) and *Carex jonesii*, *Carex illota*, *Deschampsia caespitosa*, and *Agrostis humilis* (= *Agrostis thurberiana*) in Colorado (Kittel et al. 1999). In Oregon *Eleocharis quinqueflora* (= *Eleocharis pauciflora*) and *Carex nigricans* occur with up to 40% cover (Kovalchik 1987). Forb cover includes *Caltha leptosepala*, *Mimulus primuloides*, *Ligusticum filicinum*, *Saxifraga odontoloma*, *Oreostemma alpigenum* (= *Aster alpigenus*), *Parnassia fimbriata*, *Dodecatheon jeffreyi*, and *Pedicularis groenlandica*. The fern layer is dominated by *Equisetum arvense*. The shrub layer is occasionally present and includes *Salix commutata*, *Salix planifolia*, and *Kalmia microphylla*.

Dynamics: Vegetation types within this alliance usually represent undisturbed sites that are stable (Manning and Padgett 1995). Moderate disturbance can convert this community to a mesic forb type while continued disturbance can result in bare ground. Moderately disturbed sites recover rapidly with protection due to the abundance of moisture and the dense rhizomatous nature of *Carex scopulorum* (Hansen et al. 1988).

ALLIANCE SOURCES

Authors: D. CULVER, West **Identifier:** A.1420

References: Clements 1904, Cooper and Lesica 1992, Cronquist et al. 1977, Dorn 1992, Hansen et al. 1988b, Hansen et al. 1991, Hansen et al. 1995, Hermann 1970, Hess 1981, Hess and Wasser 1982, Johnston 1987, Kettler and McMullen 1996, Kiener 1967, Kittel et al. 1994, Kittel et al. 1999a, Komarkova 1976, Komarkova 1986, Kovalchik 1987, Kovalchik 1993, Manning and Padgett 1991, Manning and Padgett 1995, May 1973, Osburn 1963, Scott-Williams 1965, Willard 1960, Willard 1963

DESCHAMPSIA CAESPITOSA SEASONALLY FLOODED HERBACEOUS ALLIANCE

Tufted Hairgrass Seasonally Flooded Herbaceous Alliance

ALLIANCE CONCEPT

Summary: Plant associations included in this alliance are circumboreal and are common in alpine, wet meadows and wetland margin habitats. Stands are found in moist, low-gradient valley bottoms and along streams throughout the mountainous areas of the western U.S. Typically, communities occur in areas of abundant snowfall where snowmelt saturates soils from late spring through early summer. Communities occur in the alpine tundra in snowmelt basins and around the edges of alpine wetlands. At lower elevations, the communities are typically wetlands, requiring wet or moist soils throughout most of the growing season. Soils are variable. Fine-textured soils retain soil moisture longer in areas of seasonal drought, and coarse substrates allow aeration in areas with perennial high water tables. This vegetation is characterized by a moderately dense to dense herbaceous layer dominated by the perennial bunchgrass *Deschampsia caespitosa*. Commonly associated graminoid species include *Carex nebrascensis*, *Carex microptera*, *Carex aquatilis*, *Juncus balticus*, *Phleum alpinum*, *Danthonia intermedia*, and *Agrostis scabra*. Common forbs include *Geum rossii*, *Ligusticum tenuifolium*,

Polygonum bistortoides, and *Caltha leptosepala*. Diagnostic of this herbaceous alliance is the dominance or codominance of *Deschampsia caespitosa* and the presence of surface water for extended periods during the growing season.

Environment: Plant associations within this alliance are circumboreal and occur in moist, low-gradient valley bottoms throughout the mountainous areas of the western United States at elevations ranging from 800-3500 m. *Deschampsia caespitosa* associations require relatively cool, moist conditions. Typically, communities occur in areas of abundant snowfall where snowmelt saturates soils from late spring through early summer. The vegetation occurs at higher elevations in the southern part of its range and in dry interior locations. Communities occur in the alpine tundra in Utah and Colorado where stands grow in snowmelt basins and around the edges of alpine wetlands. At lower elevations, the communities are typically wetlands, requiring wet or moist soils through most of the growing season. Soils are diverse. In perennially wet soils, stands of this alliance occur on sand or gravel lenses which allow adequate aeration of roots. In sites with seasonal drought, the vegetation generally occurs on finer-textured soils which drain slowly and retain moisture.

Vegetation: Associations within the *Deschampsia caespitosa* Seasonally Flooded Herbaceous Alliance (A.1408) are common alpine, wet meadow, or wetland margin types in mountain habitats of the west (Padgett et al. 1989). The vegetation is typified by a lush growth of *Deschampsia caespitosa*, a perennial bunchgrass which forms an open canopy of culms and nodding panicles. Commonly associated graminoid species include *Carex nebrascensis*, *Carex microptera*, *Carex aquatilis*, *Juncus balticus*, *Phleum alpinum*, *Danthonia intermedia*, and *Agrostis scabra* (Johnson and Simon 1987, Hess and Wasser 1982, Padgett et al. 1989). Common forbs include *Geum rossii*, *Ligusticum tenuifolium*, *Polygonum bistortoides*, and *Caltha leptosepala*. The vegetation often occurs adjacent to perennially saturated sedge wetlands dominated by *Carex utriculata*, *Carex aquatilis*, *Carex simulata*, and others. Associations of this alliance generally grade into drier meadows of forbs (*Senecio integerrimus*, *Achillea millefolium*, and others) and grasses (*Festuca*, *Muhlenbergia*, *Poa* spp.).

Dynamics: Associations within this alliance are adapted to moist and wet soils which are seasonally flooded by snowmelt and retain moisture throughout the growing season. However, stands usually occur on sites without permanent surface water. Stands appear to be tolerant of moderate intensity ground fires and late season livestock grazing (Kovalchik 1987).

Comments: The temporarily flooded, seasonally flooded, and saturated *Deschampsia caespitosa* alliances are weakly separated hydrologically. Descriptions in the literature for the associations in these three alliances are poorly differentiated with regards to soils, hydrology, and vegetation. Further review of the classification of *Deschampsia caespitosa* communities is required to clarify their differences.

ALLIANCE SOURCES

Authors: D. SARR, West **Identifier:** A.1408

References: Bonham and Ward 1970, Briggs and MacMahon 1983, Buckner 1977, Cooper et al. 1995, Crowe and Clausnitzer 1997, Daubenmire and Daubenmire 1968, Fike 1999, Franklin and Dyrness 1973, Hall 1971, Hall 1973, Hamann 1972, Hansen et al. 1988b, Hansen et al. 1991, Hansen et al. 1995, Hess and Wasser 1982, Johnson 1961b, Johnson and Simon 1985, Johnson and Simon 1987, Kettler and McMullen 1996, Kovalchik 1987, Mutz and Queiroz 1983, Padgett et al. 1988b, Padgett et al. 1989, Richard et al. 1996, Sanderson and Kettler 1996, Smith 1991, Soil Conservation Service 1978, Terwilliger et al. 1979b, Tiedemann 1972, Tuhy and Jensen 1982, Walford et al. 1997, Youngblood et al. 1985a, Youngblood et al. 1985b

ELEOCHARIS PALUSTRIS SEASONALLY FLOODED HERBACEOUS ALLIANCE Marsh Spikerush Seasonally Flooded Herbaceous Alliance

ALLIANCE CONCEPT

Summary: This herbaceous wetland alliance occurs in shallow, mostly still water throughout the much of the western United States and central Great Plains, from sea level to alpine. Stands occur on a variety of landforms including lake margins, stream terraces, floodplains, gravel bars, and wet basins (ciénegas). Sites are flat to gently sloping on any aspect. Soils and parent materials are variable, but often highly organic and derived from alluvium. Surface water is typically present for an extended period during the growing season, and the high water table remains high most of the year. The vegetation is characterized by a sparse to dense herbaceous layer that is dominated or codominated by *Eleocharis palustris*, a facultative wetland species. Because of the variety of habitats where this alliance occurs, associated species are diverse. Characteristic associates include several species of *Carex*, *Juncus*, and *Scirpus*, most notably *Carex praegracilis* and *Juncus balticus*. Other important graminoids are *Phalaris arundinacea* (= *Phalaroides arundinacea*), *Spartina pectinata*, *Panicum virgatum*, *Deschampsia caespitosa*, *Distichlis spicata*, and *Muhlenbergia asperifolia*. Forb cover is also variable, and may include *Sparganium angustifolium*, *Lemna* spp., *Potamogeton* spp., *Berula erecta*, *Rorippa nasturtium-aquaticum*, *Pedicularis groenlandica*, *Rhodiola integrifolia*, *Caltha leptosepala*, *Mentha arvensis*, *Rumex crispus*, *Iris missouriensis*, and *Ranunculus cymbalaria*. Diagnostic of this herbaceous wetland alliance is the dominance or codominance of *Eleocharis palustris* and the presence of surface water for extended periods during the growing season.

Environment: Plant associations included in this alliance are conspicuous, common emergent associations that occur in shallow, mostly still water throughout the western United States. Elevation ranges from sea level in California to 3050 m in Colorado. Stands occur on a variety of landforms including lake margins, stream terraces, floodplains, gravel bars, and wet

basins (cienegas). Stands occur on sites that are flat, 1% slope with all aspects (Crowe and Clausnitzer 1997). Soils vary from Histosols to Entisols. High-elevation stands consistently occur on organic (highly sapric) soils, or on a thick organic horizon that overlays fine to coarse alluvial material. Lower elevation stands occur on fresh alluvial deposits of fine-textured loamy sands, clays, and sandy clays (Kittel et al. 1999). Soil reaction is often alkaline (Hansen et al. 1988). All sites are saturated throughout much of the growing season. Oregon stands are located on soils derived from volcanic (andesite, basalt) or sedimentary parent materials (Crowe and Clausnitzer 1997).

At higher elevation, *Carex aquatilis* or *Carex utriculata* meadows and *Salix wolfii* or *Salix planifolia* shrublands occur within the riparian mosaic. At lower elevation, *Schoenoplectus pungens* often occurs within the stream channel while wet meadow prairies of *Panicum virgatum* and *Sorghastrum nutans* occupy the immediate streambanks and low floodplains. **Vegetation:** Plant associations within this alliance are classified as seasonally flooded, temperate or subpolar grasslands. *Eleocharis palustris*, a facultative wetland species, dominates the graminoid stratum. Cover ranges from sparse to quite dense (10-80%). *Eleocharis palustris* plant associations occur within a wide elevational range, and the species composition can be quite variable. In the Great Plains stands, co-occurring species often include *Phalaris arundinacea* (= *Phalaroides arundinacea*), *Juncus balticus*, *Carex praegracilis*, *Schoenoplectus pungens* (= *Scirpus pungens*), *Panicum virgatum*, *Carex pellita* (= *Carex lanuginosa*), *Spartina pectinata*, and *Schoenoplectus americanus* (= *Scirpus americanus*). Forb cover can also include *Sparganium angustifolium*, *Lemna* spp., and *Potamogeton* spp. (Kittel et al. 1999). *Distichlis spicata* and *Muhlenbergia asperifolia* codominate the graminoid layer in cienegas (Arizona and New Mexico). Forb cover is composed of *Berula erecta* and *Rorippa nasturtium-aquaticum*, especially in stands with deep water (Cross 1991).

At higher, montane elevations other graminoids present include *Carex aquatilis*, *Carex utriculata*, *Carex buxbaumii*, *Eleocharis rostellata*, and *Deschampsia caespitosa*. Forb cover is typically low, but can be up to 25% in some stands. Common forb species include *Pedicularis groenlandica*, *Rhodiola integrifolia*, and *Caltha leptosepala* (Hansen et al. 1995, Kittel et al. 1999).

Crowe and Clausnitzer (1997) state that *Eleocharis palustris* is an aggressive species, typically excluding other species from establishing. In the Oregon stands, associated forbs include *Mentha arvensis*, *Rumex crispus*, *Iris missouriensis*, and *Ranunculus cymbalaria*.

Dynamics: At lower elevations *Eleocharis palustris* plant associations occur well within the active channel and are inundated annually. These early seral communities colonize backwater eddies and shallow edges of slow moving reaches of small and larger rivers. The stands are probably ephemeral, as the eddies and river edges are scoured out each year during high spring flows (Kittel et al. 1999). These communities have also been described as early seral stages by Padgett et al. (1989). Padgett et al. (1989) describe light colored soils for the sites, indicating an early phase of soil development. Kovalchik (1987) reports that the lower elevation plant associations within this alliance frequently form seral communities in ponded sites between stream rehabilitation structures such as loose rock check dams.

In the montane zone, associations within this alliance occur in ponded sites on faster moving streams. If siltation occurs, sites may become dominated by *Carex utriculata*. At higher elevations, the associations appear to be stable. Stands occur near seeps on soils with deep organic layers, often sapric, and are saturated throughout the growing season.

Crowe and Clausnitzer (1997) state that *Eleocharis palustris* is of little to no forage value to livestock and wild ungulates. On seasonally drier sites, ungulate trampling may cause this species to increase (Snyder 1992 as cited in Crowe and Clausnitzer 1997). However, this species does provide seed forage and cover to ducks and geese (Kovalchik 1987).

ALLIANCE SOURCES

Authors: D. CULVER, West **Identifier:** A.1422

References: Baker 1983c, Baker and Kennedy 1985, Brotherson 1987, Brotherson and Barnes 1984, Brown 1982, Bunin 1985, Cronquist et al. 1977, Cross 1991, Crowe and Clausnitzer 1997, Durkin et al. 1995, Ellis et al. 1979, Flowers 1962, Hall and Hansen 1997, Hansen et al. 1988b, Hansen et al. 1991, Hansen et al. 1995, Hendrickson and Minckley 1984, Johnston 1987, Kartesz 1994a, Kettler and McMullen 1996, Kittel and Lederer 1993, Kittel et al. 1994, Kittel et al. 1999a, Kovalchik 1987, Kovalchik 1993, Manning and Padgett 1995, Muldavin et al. 2000a, Mutel 1973, Mutel and Marr 1973, Padgett et al. 1988b, Padgett et al. 1989, Ramaley 1919a, Ramaley 1942, Reid et al. 1994, Sawyer and Keeler-Wolf 1995, Shupe et al. 1986, Stearns-Roger Inc. 1978, Stewart 1940, Sturges 1968, Youngblood et al. 1985a

ELEOCHARIS PALUSTRIS HERBACEOUS VEGETATION Marsh Spikerush Herbaceous Vegetation

ELEMENT CONCEPT

Summary: This spikerush wet meadow community is found in the central Great Plains of the United States and Canada and in the western United States. Stands occur in small depressions in intermittent streambeds or depression ponds that flood early in the season and may dry out by summer. Stands are composed of submersed and emergent rooted vegetation under 1 m tall that is dominated by *Eleocharis palustris*, often in nearly pure stands. Soils are generally fine-textured.

Environment: This wetland occurs across the central and northwestern Great Plains and western United States. Elevations range from near sea level to 3050 m (in Colorado). In eastern Washington and Idaho it occurs in valleys and canyon bottoms with low-gradient streams, sloughs, and along the margins of ponds and lakes (Kovalchik 1993). In northwest Nebraska and

southwest South Dakota, this community occurs in small depressions in intermittent streambeds and depression ponds that flood early in the season and dry out by summer. Soils are silty clay formed from weathered siltstone and shale (Steinauer and Rolfsmeier 2000). In southwestern South Dakota, the type occupies depression ponds in prairies (H. Marriott pers. comm. 1999). In Utah stands are described from small playas on floodplain terraces of a large river (Von Loh 2000).

In Colorado this community type occurs on the bottom of ephemeral ponds or playas (Baker and Kennedy 1985), or is associated with small to moderate-sized ponds or the edges of larger lakes and reservoirs (Bunin 1985, Padgett et al. 1989). The sites are generally only seasonally flooded, but remain moist throughout the year (Bunin 1985, Padgett et al. 1989). Elevations range from 1525-2750 m (5000-9020 feet).

The soils of Baker and Kennedy's (1985) stands were derived from Quaternary alluvium, with a heavy clay content and an average pH of 7.8, slightly alkaline. The soils reported by Padgett et al. (1989) were mineral soils with fine-loamy to fine particle sizes or organic. They are commonly ponded throughout the growing season and have developed from pond siltation. Hansen et al. (1988a) indicate that *Eleocharis palustris* is alkaline-tolerant.

Vegetation: This wetland association is dominated by submersed and emergent rooted vegetation under 1 m tall and occurs across the northwestern Great Plains and western U.S. within a wide elevational range. The species composition can be quite variable, but this community is easy to recognize by the bright green, nearly pure stands of *Eleocharis palustris*. Vegetation cover can be sparse to dense (10-90%), but *Eleocharis palustris* is the dominant species, and the only species with 100% constancy. Other species, when present, can contribute as much as 40% cover, but never exceed that of the *Eleocharis palustris* cover. Some of this variation is described from Colorado (Kittel et al. 1999, Baker and Kennedy 1985). Co-occurring species in low-elevation stands on the western slope can include *Phalaris arundinacea* (= *Phalaroides arundinacea*), *Juncus balticus*, *Hordeum jubatum*, *Pascopyrum smithii*, *Schoenoplectus americanus* (= *Scirpus americanus*), *Sparganium angustifolium*, species of *Lemna* and *Potamogeton*, as well as the introduced *Melilotus officinalis* and *Bromus inermis*. On the eastern plains of Colorado co-occurring species can include *Leersia oryzoides*, *Schoenoplectus pungens* (= *Scirpus pungens*), *Panicum virgatum*, *Carex pellita* (= *Carex lanuginosa*), and *Spartina pectinata*. At montane elevations, other graminoids, such as *Carex aquatilis*, *Carex utriculata*, and *Deschampsia caespitosa* are present. Forb cover is typically low, but can be occasionally abundant (30%) in some stands. Forb species include *Pedicularis groenlandica*, *Rhodiola integrifolia*, and *Caltha leptosepala*.

In stands from eastern Washington, associates include *Carex utriculata*, *Cicuta douglasii*, and species of *Glyceria* and *Potamogeton*. In northwestern Nebraska, stands are dominated *Eleocharis acicularis* and *Eleocharis palustris* which commonly cover the bottoms of the pools and emerge above the water as the pools dry out. Ephemeral submersed aquatics, such as *Callitriche palustris* (= *Callitriche verna*), *Potamogeton diversifolius* and *Marsilea vestita*, may be present. As the pools dry out in mid-summer, ephemeral annual forbs, such as *Limosella aquatica* and *Plagiobothrys scouleri*, may appear. By late summer *Amaranthus californicus* and *Gnaphalium palustre* may dominate in the lowest parts of the depression (Steinauer and Rolfsmeier 2000). In southwestern South Dakota, vegetation is composed of nearly homogeneous stands of *Eleocharis palustris*. Other emergents, such as *Polygonum amphibium*, *Marsilea vestita*, and *Eleocharis ovata*, are occasionally found. Herbaceous cover is greater than 75% except in areas of deeper open water where floating and submerged aquatic plants occur, including *Bacopa rotundifolia* and *Heteranthera limosa* (H. Marriott pers. comm. 1999). In lower elevation Utah stands *Glaux maritima*, *Distichlis spicata*, and *Juncus balticus* were important associates (Brotherson and Barnes 1984).

Few stand data are available for Colorado examples. Generally, it appears that this community is dominated by *Eleocharis palustris*, forming a scattered to dense overstory, often with few associated species. Commonly associated graminoids include *Hordeum jubatum* and *Pascopyrum smithii*. Forbs present may include *Atriplex argentea*, *Polygonum aviculare*, and *Rorippa sinuata* (Baker and Kennedy 1985). The higher elevation stands may include a slightly different suite of species, but no stand data are available. Ramaley (1942) described a *Distichlis spicata*-dominated salt meadow on a lakeshore in the San Luis Valley which was ringed by *Eleocharis palustris*. Communities in Utah include *Eleocharis acicularis* and *Alopecurus aequalis* as likely associates (Padgett et al. 1989).

Dynamics: The hydrological regime is critically important to this association. Most stands are seasonally to permanently flooded, although some in the Great Plains occur under intermittently to temporarily flooded conditions.

Baker and Kennedy (1985) suggest that domestic livestock grazing may tend to result in increases in *Hordeum jubatum*, *Bassia scoparia*, and *Polygonum aviculare*. However, Hansen et al. (1988a) suggest that palatability of *Eleocharis palustris* is low for both domestic and wild animals, but that heavy grazing may increase this rhizomatous species and spread it onto adjacent sites. Trampling damage may occur to this type when animals heavily use the sites supporting it, particularly during drought years (Hansen et al. 1988a). Water level fluctuations over a year of greater than 1 m will not support this type (Hansen et al. 1988a).

Similar Associations:

- *Eleocharis palustris* - *Distichlis spicata* Herbaceous Vegetation (CEGL001834)
 - *Eleocharis palustris* - *Juncus balticus* Herbaceous Vegetation (CEGL001835)
 - *Eleocharis palustris* - (*Eleocharis compressa*) - *Leptochloa fusca* ssp. *fascicularis* Herbaceous Vegetation (CEGL002259)
- GRank & Reasons:** G5 (96-02-01).

Comments:**ELEMENT DISTRIBUTION**

Range: This spikerush wet meadow community is found in the central Great Plains of the United States and Canada and in the western United States.

Nations: CA US

States/Provinces: BC:S4, CA?, CO:S4, ID:S3, MT:S5, NE:S?, NV:SR, OR:S5, SD:S?, SK:S?, UT:S3?, WA:S3?, WY:S3

ELEMENT SOURCES

Authors: D. Faber-Langendoen, mod. K. Schulz, mod. M.S. Reid, WCS **Confidence:** 1 **Identifier:** CEGLO01833

References: Baker 1983c, Baker and Kennedy 1985, Billings 1945, Bourgeron and Engelking 1994, Brotherson and Barnes 1984, Bunin 1985, Driscoll et al. 1984, Ellis et al. 1979, Flowers 1962, Hall and Hansen 1997, Hansen et al. 1988a, Hansen et al. 1988b, Hansen et al. 1991, Hansen et al. 1995, Kettler and McMullen 1996, Kittel and Lederer 1993, Kittel et al. 1994, Kittel et al. 1999a, Kovalchik 1987, Kovalchik 1993, Mutel 1973, Mutel and Marr 1973, Padgett et al. 1988b, Padgett et al. 1989, Penfound 1953, Ramaley 1919a, Ramaley 1942, Stearns-Roger Inc. 1978, Steinauer and Rolfsmeier 2000, Stewart 1940, Von Loh 2000, Youngblood et al. 1985a

JUNCUS BALTICUS SEASONALLY FLOODED HERBACEOUS ALLIANCEBaltic Rush Seasonally Flooded Herbaceous Alliance

ALLIANCE CONCEPT

Summary: This alliance often occupies seasonally flooded swales and wet, low- to mid-elevation sites. Habitats are often alkaline. It is a wide-ranging alliance, occurring from the plains to montane regions, and has much variability. Elevations range from sea level in California to 3500 m in Colorado. Montane plant associations can occur on alluvial terraces, floodplains, overflow channels, seeps, meadows, and near springs. Sites are typically gently sloping (1-3%) on all aspects. An association was documented in northern California coastal salt marshes. Soils are mineral with dark surface horizons containing large amounts of well-decomposed organic matter. Soils are Mollisols, or rarely Entisols. Soil texture ranges from silt to sandy loam. Water tables are often at or near the soil surface in early summer but may drop below 50 cm by late August. Soil reaction ranges from neutral to mildly alkaline (pH 7.0-8.0). The graminoid layer is dense with up to 98% cover and dominated by *Juncus balticus*, a creeping, often sod-forming, rhizomatous perennial. Other graminoid cover is minor but can include *Carex pellita* (= *Carex lanuginosa*), *Carex aquatilis*, *Carex canescens*, *Leymus cinereus*, *Deschampsia caespitosa*, *Hordeum jubatum*, or *Sporobolus airoides*. Forb cover is typically minor and may include *Achillea millefolium*, *Iris missouriensis*, or *Geum macrophyllum*. The plant association from California is composed of *Distichlis spicata*, *Carex lyngbyei*, *Carex obnupta*, and *Schoenoplectus robustus* (= *Scirpus robustus*). Occasionally, a few tree or shrub seedlings are present, including *Populus angustifolia*, *Dasiphora fruticosa* ssp. *floribunda* (= *Pentaphylloides floribunda*), and *Salix exigua*. *Salix exigua* shrublands, *Distichlis spicata* marshes, or *Carex* spp. meadows occur in adjacent riparian areas. *Abies lasiocarpa* - *Picea engelmannii*, *Pseudotsuga menziesii*, and *Populus tremuloides* forests, *Pinus edulis* - *Juniperus* spp. woodlands, and *Ericameria nauseosa* (= *Chrysothamnus nauseosus*), *Sarcobatus vermiculatus*, and *Artemisia tridentata* shrublands occur on adjacent hillslopes. In the Shenandoah Valley of Virginia, an association in this alliance occurs in seasonally flooded areas on level alluvium with somewhat poorly to poorly drained soils. In Virginia associated species include *Carex trichocarpa*, *Lysimachia quadriflora*, *Lythrum alatum* var. *alatum*, *Filipendula rubra*, *Juncus balticus*, *Carex prairea*, *Carex buxbaumii*, *Cladium mariscoides*, *Iris versicolor*, *Agrostis gigantea* (= *Agrostis alba*), *Scirpus atrovirens*, *Scirpus pendulus*, *Juncus dudleyi*, *Holcus lanatus* (alien), *Mentha arvensis* (alien), *Toxicodendron radicans*, *Solidago canadensis*, and *Symphotrichum puniceum* (= *Aster puniceus*). In low-disturbance areas, *Juncus balticus* plant associations appear to be a stable, climax community. However, in some areas, this association is considered to be grazing-induced. *Juncus balticus* is considered an increaser due to its low forage value and high tolerance to grazing. It usually increases in abundance on sites formerly dominated by *Deschampsia caespitosa* or *Calamagrostis canadensis*. Nearly pure stands of *Juncus balticus* indicate that the site may have been heavily grazed in the past. *Juncus balticus* is listed as a facultative wetland species.

Environment: Plant associations within this alliance are widely distributed in wet, often alkaline places, from the plains to mountains. Elevation ranges from sea level in California to 3500 m in Colorado. Montane plant associations can occur on alluvial terraces, floodplains, overflow channels, seeps, meadows, and near springs. Sites are typically gentle (1-3%) slope on all aspects. Barbour and Major (1977) state that *Juncus balticus* occurs in northern California coastal salt marshes.

Soils are mineral with dark surface horizons containing large amounts of well-decomposed organic matter (Tuhý and Jensen 1982). Soils are Mollisols, or rarely Entisols. Soil texture ranges from silt to sandy loam. Water tables are often at or near the soil surface in early summer, but may drop below 50 cm by late August. Soil reaction ranges from neutral to mildly alkaline (pH 7.0-8.0) (Hansen et al. 1995).

Salix exigua shrublands, *Distichlis spicata* marshes, or *Carex* spp. meadows occur in adjacent wet riparian areas. *Sarcobatus vermiculatus* and *Artemisia tridentata* shrublands occur on drier alluvial terraces and adjacent hillslopes. *Abies*

lasiocarpa - *Picea engelmannii*, *Pseudotsuga menziesii*, and *Populus tremuloides* forests, *Pinus edulis* - *Juniperus* spp. woodlands, and *Ericameria nauseosa* shrublands occur on adjacent hillslopes.

Vegetation: Plant associations within this alliance are classified as seasonally flooded, temperate or subpolar grasslands. They are dominated by a thick stand of 10-98% cover of *Juncus balticus*, a facultative wetland species. Other graminoid cover is minor, but can include *Carex pellita* (= *Carex lanuginosa*), *Carex aquatilis*, *Carex canescens*, *Leymus cinereus*, *Deschampsia caespitosa*, *Hordeum jubatum*, or *Sporobolus airoides*. Forb cover is typically minor and may include *Achillea millefolium*, *Iris missouriensis*, or *Geum macrophyllum*. The plant association from California is composed of *Distichlis spicata*, *Carex lyngbyei*, *Carex obnupta*, and *Schoenoplectus robustus* (= *Scirpus robustus*). Occasionally, a few tree or shrub seedlings are present including *Populus angustifolia*, *Dasiphora fruticosa* ssp. *floribunda* (= *Pentaphylloides floribunda*), and *Salix exigua*. Stands often contain adventive species, e.g., *Poa pratensis* and *Phleum pratense*.

Dynamics: In low-disturbance areas, the *Juncus balticus* stands of this alliance appear to be a stable, late seral communities. They occupy frequently inundated swales and wet, low- to mid-elevation sites (Kittel and Lederer 1993). However, in some areas, stands of this alliance may be considered to be grazing-induced (Padgett et al. 1989). *Juncus balticus* is considered an increaser due to its low forage value and high tolerance to grazing (USFS 1937 as cited in Kittel et al. 1999, Hansen et al. 1995). It usually increases in abundance on sites formerly dominated by *Deschampsia caespitosa* or *Calamagrostis canadensis*. Nearly pure stands of *Juncus balticus* indicate that the site may have been heavily grazed in the past (Hansen et al. 1995).

ALLIANCE SOURCES

Authors: ECS 96, MOD. D. CULVER, MP, West **Identifier:** A.1374

References: Barbour and Major 1977, Blackburn et al. 1971, Brooks and Clemants 2000, Brotherson and Barnes 1984, Brown 1982, Bunin 1985, Crowe and Clausnitzer 1997, Flowers 1962, Grossman et al. 1994, Hansen et al. 1988b, Hansen et al. 1991, Hansen et al. 1995, Hess 1981, Johnston 1987, Jones and Walford 1995, Kartesz 1994a, Kittel and Lederer 1993, Kittel et al. 1994, Kittel et al. 1999a, Komarkova 1986, Kovalchik 1987, Kunze 1994, Manning 1988, Manning and Padgett 1995, Mutel 1973, Mutz and Graham 1982, Olson and Gerhart 1982, Padgett 1982, Padgett et al. 1989, Rawinski 1992, Rector 1979, Richard et al. 1996, Roberts et al. 1992, Sawyer and Keeler-Wolf 1995, Shupe et al. 1986, Sneddon et al. 1996, Stewart 1940, Tuhy and Jensen 1982, Wasser and Hess 1982, Youngblood et al. 1985a

JUNCUS BALTICUS HERBACEOUS VEGETATION Baltic Rush Herbaceous Vegetation

ELEMENT CONCEPT

Summary: This Baltic rush wet meadow community is found widely throughout the western United States. This wet meadow vegetation occurs as small, dense patches on flat stream benches, along overflow channels, and near springs. Soils are variable and range from poorly to well-drained, sandy clay loam to fine sand-textured and are usually mottled or gleyed. Stands are characterized by a dense sward of *Juncus balticus* and often minor cover of *Carex* species, including *Carex aquatilis*, *Carex praegracilis*, *Carex nebrascensis*, or *Carex utriculata*. Other common species include *Deschampsia caespitosa*, *Distichlis spicata*, *Glyceria striata*, *Hordeum jubatum*, *Muhlenbergia asperifolia*, *Phleum alpinum*, and *Sporobolus airoides*. The introduced perennial sod grasses *Poa pratensis* or *Agrostis stolonifera* codominate some stands. Forb cover is generally low and includes wetland species like *Caltha leptosepala*, *Rumex aquaticus* and *Dodecatheon pulchellum*. *Iris missouriensis* can be common in heavily grazed stands. Shrubs are not common. This association is often considered to be a grazing-induced community since it increases with disturbance.

Environment: This widespread herbaceous wetland community is found throughout western North America. Elevation ranges from 1420-3500 m. Stands usually occur as small, dense patches on flat to gently sloping sites near seeps and streams. Stream channels are highly variable in size and type ranging from narrow to moderately wide, and deeply entrenched to very sinuous (Kittel et al. 1999). Soils are also variable and range from alluvial sandy and well-drained, to poorly drained silty clay loam, to organic; however, soils tend to be finer-textured, alkaline and may be saline (Brotherson and Barnes 1984, Kittel et al. 1999, Padgett et al. 1989). Cobbles and gravel are common on many sites, and gleyed and mottled horizons are often present because of flooding or high water tables (Kittel et al. 1999).

Vegetation: This association is characterized by a low (<50 cm), dense graminoid layer dominated by the rhizomatous perennial *Juncus balticus*. Minor cover of *Carex* species, including *Carex aquatilis*, *Carex praegracilis*, *Carex nebrascensis* or *Carex utriculata*, is often present. Other common graminoids include *Deschampsia caespitosa*, *Distichlis spicata*, *Glyceria striata*, *Hordeum jubatum*, *Muhlenbergia asperifolia*, *Phleum alpinum*, and *Sporobolus airoides*. Forb cover is generally low, but may include *Caltha leptosepala*, *Glaux maritima*, *Maianthemum stellatum*, *Rumex aquaticus*, *Cirsium scariosum* (= *Cirsium tioganum*), *Achillea millefolium*, *Potentilla plattensis*, *Polygonum bistortoides*, *Dodecatheon pulchellum*, and *Iris missouriensis*. Shrubs are not common, however occasional *Salix* spp. may occur. Some stands may be codominated by the introduced perennial sod grasses *Poa pratensis* or *Agrostis stolonifera*. Other introduced species, such as *Taraxacum officinale*, *Trifolium* spp., *Cirsium arvense*, *Lactuca serriola*, *Phleum pratense*, and *Thinopyrum intermedium*, may occur in disturbed stands.

Dynamics: This association is considered by some to be a grazing-induced community because *Juncus balticus* is tolerant of grazing (low palatability when mature) and increases with grazing disturbance (Hansen et al. 1995, Padgett et al. 1989). Nearly pure stands of *Juncus balticus* may indicate that the site was heavily grazed in the past (Hansen et al. 1995). However, this association also occurs as a stable, late-seral community in areas with low disturbance (Kittel and Lederer 1993).

Similar Associations:

- Eleocharis palustris - Juncus balticus Herbaceous Vegetation (CEGL001835)
- Juncus balticus - Carex rossii Herbaceous Vegetation (CEGL001839)

GRank & Reasons: G5 (96-02-01).

High-ranked species:

Comments: This association is often considered to be a grazing-induced community since it increases with grazing disturbance.

ELEMENT DISTRIBUTION

Range: This Baltic rush wet meadow community is found widely throughout the western United States, ranging from South Dakota and Montana west to Washington, south to possibly California, and east to New Mexico.

Nations: CA US

States/Provinces: BC:S3, CA?, CO:S5, ID:S5, MT:S5, NM:S4, NV:S?, OR:S5, SD:S?, UT:S3S4, WA:S3S4, WY:S3

ELEMENT SOURCES

Authors: J. Drake, mod. D. Faber-Langendoen, mod. K. Schulz, WCS **Confidence:** 1 **Identifier:** CEGL001838

References: Baker 1984a, Bourgeron and Engelking 1994, Brotherson and Barnes 1984, Bunin 1985, Cowardin et al. 1979, Driscoll et al. 1984, Faber-Langendoen 2001, Flowers 1962, Hall and Hansen 1997, Hansen et al. 1988b, Hansen et al. 1991, Hansen et al. 1995, Hess 1981, Johnston 1987, Jones and Walford 1995, Kartesz 1994a, Kittel and Lederer 1993, Kittel et al. 1994, Kittel et al. 1999a, Komarkova 1986, Manning 1988, Muldavin et al. 2000a, Mutel 1973, Mutz and Graham 1982, Olson and Gerhart 1982, Padgett 1982, Padgett et al. 1989, Rector 1979, Richard et al. 1996, Shupe et al. 1986, Stewart 1940, Tuhy and Jensen 1982, Wasser and Hess 1982, Youngblood et al. 1985a

SPARTINA GRACILIS SEASONALLY FLOODED HERBACEOUS ALLIANCEAlkali

Cordgrass Seasonally Flooded Herbaceous Alliance

ALLIANCE CONCEPT

Summary: This tall grassland alliance is found on scattered low-elevation sites of the northern and western Great Plains, and in northern portions of the Intermountain West. Locations supporting this alliance are moist, poorly drained, often alkaline areas along ephemeral, intermittent or perennial streams, as well as swales, meadows, the margins of marshes and ponds and on moist sandy overflow channels and backwater areas of large rivers. Water tables are typically high, within 1 m of the surface, but the sites are not permanently flooded. Soils are fine-textured, and range from clays to silt-loam, and are usually slightly to moderately alkaline, but non-saline. Vegetation included in this alliance is characterized by a tall perennial graminoid layer that is dominated by *Spartina gracilis*, sometimes forming pure stands. Other graminoids present, and occasionally codominant, include *Schoenoplectus pungens* (= *Scirpus pungens*), *Juncus balticus*, and *Pascopyrum smithii*. Forb species tend to be weedy, such as *Grindelia squarrosa*, *Glycyrrhiza lepidota*, and *Xanthium strumarium*. These forbs can be somewhat abundant in disturbed locations, but otherwise are found in small amounts. Diagnostic of this alliance is the *Spartina gracilis*-dominated tall graminoid layer in a grassland that has a relatively shallow water table and is flooded for an extended period during the growing season.

Environment: This alliance is found on scattered low-elevation sites of the northern and western Great Plains, and in northern portions of the Intermountain West. Elevations range from 716 m in Montana to over 2200 m in south-central Colorado. Locations supporting this alliance are moist, poorly drained, often alkaline areas along ephemeral, intermittent or perennial streams, as well as swales, meadows, and the margins of marshes and ponds. Jones and Walford (1995) report that stands occur along low-gradient, small, meandering creeks. Kittel et al. (1999) found stands on moist sandy overflow channels and backwater areas of large rivers on the eastern plains of Colorado. The water table is typically high, within 1 m of the surface, but the sites are not permanently flooded. Soils are fine-textured, and range from clays to silt-loam, and usually slightly to moderately alkaline (Ungar 1974, Hansen et al. 1995). Soil water movement is rapid enough to preclude the accumulation of salts in the surface horizon.

Vegetation: This lower elevation alliance is dominated by tall perennial graminoids. *Spartina gracilis* is usually the dominant, although cover may be moderate (30-60%). Vigorous growth from rhizomes allows this species to sometimes form pure stands. Other graminoids present, and occasionally codominant, can include *Schoenoplectus pungens* (= *Scirpus pungens*), *Juncus balticus*, and *Pascopyrum smithii*. Forb species present tend to be weedy, such as *Grindelia squarrosa*, *Glycyrrhiza lepidota*, and *Xanthium strumarium*. These forbs can be somewhat abundant in disturbed locations, but otherwise are found in small amounts.

Adjacent riparian vegetation can include *Ribes* spp., *Chrysothamnus* spp., *Artemisia cana*, or *Shepherdia argentea* shrublands on adjacent floodplains. *Eleocharis* meadows or *Scirpus* marshes can occur on adjacent wet swales, overflow channels, or closer to open water. Adjacent upland vegetation includes *Pascopyrum smithii*-dominated grasslands, *Artemisia tridentata* shrublands or *Pinus edulis* - *Juniperus monosperma* woodlands on surrounding hill slopes in Colorado.

Dynamics: *Spartina gracilis* tolerates alkaline soils to the exclusion of other species. It also tolerates burial by flood deposition and readily re-sprouts, pushing up sharp shoots (Weaver 1965). If the soil salinity drops, the community will become dominated by less alkaline-tolerant plants.

Stands of *Spartina pectinata* have high production rates, however the rough-edged leaves make for poor forage quality, and it is not readily eaten by livestock or wildlife. Its tall height and thick growth provide shade and cover for wildlife and certain bird species (Hansen et al. 1988). It can make excellent hay if cut two or three times each growing season, thereby reducing forage coarseness (Weaver 1965, Hansen et al. 1988). *Spartina gracilis* may respond in similar ways to *Spartina pectinata*.

Comments: Stands presently included in this alliance have been poorly reviewed against each other. Examples are apparently uncommon, and few authors have described them.

ALLIANCE SOURCES

Authors: M.S. REID, West **Identifier:** A.1407

References: Baker 1984b, Evans 1989b, Hansen et al. 1988b, Hansen et al. 1995, Hanson 1929, Jones and Walford 1995, Kittel et al. 1999a, Sawyer and Keeler-Wolf 1995, Ungar 1972, Ungar 1974b, Ungar 1974c, Weaver 1965

SPARTINA GRACILIS HERBACEOUS VEGETATION Alkali Cordgrass Herbaceous Vegetation

ELEMENT CONCEPT

Summary: In Colorado, these wetland meadows have a sparse to thick herbaceous layer of grasses and grass-like plants that is dominated by *Spartina gracilis*. Few stands have been documented in Colorado, so its classification is tentative.

Information on stands that occur outside Colorado will be added later.

GRank & Reasons: GU (94-02-23).

ELEMENT DISTRIBUTION

Range:

Nations: US

States/Provinces: CA:SU, CO:SU, MT?, NV:SU, UT?, WA?, WY:S?

ELEMENT SOURCES

Authors: WCS **Confidence:** 3 **Identifier:** Cegl001588

References: Baker 1984b, Bourgeron and Engelking 1994, Driscoll et al. 1984, Hanson 1929, Sawyer and Keeler-Wolf 1995, Ungar 1972, Ungar 1974c

SCHOENOPLECTUS ACUTUS - (SCHOENOPLECTUS TABERNAEMONTANI)

SEMIPERMANENTLY FLOODED HERBACEOUS ALLIANCE Hardstem Bulrush - (Softstem Bulrush) Semipermanently Flooded Herbaceous Alliance

ALLIANCE CONCEPT

Summary: This alliance is found in the midwestern and western United States and central Canada. Vegetation is characterized by medium to tall graminoids which typically range from 1 to over 2 m. The vegetation is moderately dense to dense. Some stands are heavily dominated by one or two *Scirpus* species while others have several graminoids common throughout the stand. The most abundant species are typically *Schoenoplectus acutus* (= *Scirpus acutus*), *Schoenoplectus fluviatilis* (= *Scirpus fluviatilis*), and *Schoenoplectus tabernaemontani* (= *Scirpus tabernaemontani*). Species composition and abundance can vary from year to year depending mostly on water level fluctuations. In most years, typical species include *Lemna* spp., *Phragmites australis*, *Schoenoplectus americanus* (= *Scirpus americanus*) (in alkaline stands), *Triglochin maritima* (in alkaline stands), *Typha latifolia*, and *Utricularia macrorhiza*. *Potamogeton* spp. often occur in the deeper parts of stands of this alliance and where emergent species are not densely packed. Shrubs, such as *Salix* spp., are not common but may become established in shallow water areas. During droughts, species more tolerant of low water, such as *Polygonum amphibium*, may invade and alter the species composition of stands of this alliance.

Stands of this alliance are flooded for most or all of the growing season. Stands can have water from 0 (exposed soil) to approximately 1.5 m deep, but usually are less than 1 m. Within a stand, water levels can vary by up to 1 m during the year. The water can be fresh to mildly saline throughout most of this alliance's range; however, in the Nebraska Sandhills, some stands occur in moderately alkaline water. Across the range of this alliance, soils are deep, poorly drained, muck, peat, or mineral.

Environment: This relatively widespread alliance occurs on pond and lake margins, and in backwater areas. It also occupies basins where the water table may remain relatively high, but can drop below the soil surface late in the growing season. Elevations range from sea level in coastal areas to 2025 m in Montana. Stands of this alliance are flooded for most or all of the growing season. Stands can have water from 0 (exposed soil) to approximately 1.5 m deep, but usually are less than 1 m (Tolstead 1942, Steinauer 1989). Within a stand, water levels can vary by up to 1 m during the year (Tolstead 1942). The water can be fresh to mildly saline throughout most of this alliance's range (Stewart and Kantrud 1971), however, in the Nebraska Sandhills some stands occur in moderately alkaline water (Steinauer 1989). Across the range of this alliance, soils are deep, poorly drained muck, peat, or mineral. Adjacent wetter sites are typically dominated by *Typha latifolia*, while drier sites support herbaceous communities dominated by *Carex* spp., *Poa pratensis* or other grasses.

Vegetation: This alliance is found in the midwestern and western United States and central Canada. Vegetation is characterized by medium to tall graminoids which typically range from 1 to over 2 m (Weaver 1960). The vegetation is moderately dense to dense. Some stands are heavily dominated by one or two *Schoenoplectus* species while others have several graminoids common throughout the stand. The most abundant species are typically *Schoenoplectus acutus* (= *Scirpus acutus*), *Schoenoplectus fluviatilis* (= *Scirpus fluviatilis*), and *Schoenoplectus tabernaemontani* (= *Scirpus tabernaemontani*). Species composition and abundance can vary from year-to-year depending mostly on water level fluctuations. In most years, typical species include *Lemna* spp., *Phragmites australis*, *Schoenoplectus americanus* (= *Scirpus americanus*) (in alkaline stands), *Triglochin maritima* (in alkaline stands), *Typha latifolia*, and *Utricularia macrorhiza*. *Potamogeton* spp. often occur in the deeper parts of stands of this alliance and where emergent species are not densely packed. Shrubs, such as *Salix* spp., are not common, but may become established in shallow water areas. During droughts, species more tolerant of low water, such as *Polygonum amphibium*, may invade and alter the species composition of stands of this alliance.

Dynamics: *Schoenoplectus acutus* and *Schoenoplectus tabernaemontani* are early colonizers of suitable habitats (Hansen et al. 1995), and are able to persist under wet conditions. *Schoenoplectus* spp. stands are generally considered permanent wetland communities. They will remain in place unless the hydrologic regime is severely altered. If water levels have fallen, stands of this alliance can burn in either late fall or early spring. Stands of *Schoenoplectus* are important to wildlife species, especially birds, by providing cover and nesting habitat.

ALLIANCE SOURCES

Authors: MCS, MOD. M.S. REID, MP, Midwest **Identifier:** A.1443

References: Christy et al. 1998, Faber-Langendoen et al. 1996, Faber-Langendoen et al. 1997, Fike 1999, Hansen et al. 1991, Hansen et al. 1995, Kunze 1994, Smith 1991, Steinauer 1989, Stewart and Kantrud 1971, Tolstead 1942, Weaver 1960

SCHOENOPLECTUS ACUTUS HERBACEOUS VEGETATION Hardstem Bulrush Herbaceous Vegetation

ELEMENT CONCEPT

Summary: This association is a common emergent herbaceous wetland found mostly in the interior western U.S. ranging from the Puget Sound of Washington to Montana south to California, Nevada and Utah. Stands occur along low-gradient, meandering, usually perennial streams, river floodplain basins, and around the margins of ponds and shallow lakes especially in backwater areas. Some sites are flooded most of the year with about 1 m of fresh to somewhat saline or alkaline water. Other sites, however, dry up enough in late summer to where the water table drops below the ground surface, though the soils are still partially saturated. Soils are generally deep, organic, alkaline, poorly drained and fine-textured, but range in soil textures from sand to clay to organic muck. The soils may be normal or saline. Vegetation is characterized by a dense tall herbaceous vegetation layer 1-3 m tall that is dominated by *Schoenoplectus acutus* (= *Scirpus acutus*), often occurring as a near monoculture. Associated species include low cover of *Mentha arvensis*, *Polygonum amphibium*, *Sagittaria latifolia*, and species of *Carex*, *Eleocharis*, *Rumex*, and *Typha*. Early in the growing season or at permanently flooded sites, aquatic species such as *Potamogeton* spp. and *Lemna minor* may be present to abundant. Stands of this association contain no tree or shrub layer, but a few sites have been invaded by the introduced shrub *Tamarix* spp.

Environment: This association is a common emergent herbaceous wetland found mostly in the interior western U.S. Elevations range from near sea level to 2030 m. Stands occur along low-gradient, meandering, usually perennial streams, river floodplain basins and around the margins of ponds and shallow lakes especially in backwater areas. Some sites are flooded most of the year with about 1 m of fresh to somewhat saline or alkaline water. Other sites, however, dry up enough in late summer to where the water table drops below the ground surface, though the soils are still partially saturated. Soils are generally deep, organic, alkaline, poorly drained and fine-textured, but range in soil textures from sand to clay to organic muck. The soils may be normal or saline.

Vegetation: This wetland association is characterized by a dense tall herbaceous vegetation layer 1-3 m tall that is dominated by *Schoenoplectus acutus* (= *Scirpus acutus*), often occurring as a near monoculture. Associated species include low cover of *Mentha arvensis*, *Polygonum amphibium*, *Sagittaria latifolia*, and species of *Carex*, *Eleocharis*, *Rumex*, and *Typha*. Early in the growing season or at the more permanently flooded sites, aquatic species such as *Potamogeton* spp. and *Lemna minor* may be present to abundant. Stands of this association contain no tree or shrub layer, but a few sites have been invaded by the introduced shrub *Tamarix* spp.

Similar Associations:

- *Schoenoplectus acutus* - *Typha latifolia* - (*Schoenoplectus tabernaemontani*) Sandhills Herbaceous Vegetation (CEGL002030)
- *Schoenoplectus acutus* - (*Schoenoplectus fluviatilis*) Freshwater Herbaceous Vegetation (CEGL002225)
- *Typha* spp. - *Schoenoplectus acutus* - Mixed Herbs Midwest Herbaceous Vegetation (CEGL002229)

GRank & Reasons: G5 (96-02-01).

Comments: This association appears to be somewhat variable in flood regime. It is flooded less time than some of the other *Schoenoplectus acutus* associations in this semipermanently flooded alliance with some stands included in this association occurring in a seasonally flooded hydrologic regime. However, stands described by Kunze (1994) from western Washington were permanently flooded with shallow water (about 1 m deep). Additional research is needed to determine if the different hydrological regimes indicate a need to split out new associations.

ELEMENT DISTRIBUTION

Range: This association is a common emergent wetland found mostly in the interior western U.S. from Washington to Montana south to California, Nevada and Utah.

Nations: US

States/Provinces: CA:S3?, ID:S4, MT:S5, NV:S?, OR:S5, UT:S?, WA:S4

ELEMENT SOURCES

Authors: K.A. Schulz, WCS **Confidence:** 1 **Identifier:** CEGL001840

References: Bourgeron and Engelking 1994, Bundy et al. 1996, Dethier 1990, Driscoll et al. 1984, Evans 1989a, Hansen et al. 1991, Hansen et al. 1995, Kunze 1994

. SCHOENOPECTUS PUNGENS SEMIPERMANENTLY FLOODED HERBACEOUS ALLIANCE Threesquare Semipermanently Flooded Herbaceous Alliance

ALLIANCE CONCEPT

Summary: This alliance, found in the northern Great Plains, Utah, and Nevada, is made up of graminoid-dominated communities found in saline wetlands. Medium-tall and short graminoids predominate. Woody species are very uncommon. *Schoenoplectus pungens* (= *Scirpus pungens*), *Suaeda calceoliformis*, *Distichlis spicata* (on drier margins), and *Ruppia maritima* are all common species. *Chenopodium incanum*, *Monolepis nuttalliana*, and *Picradeniopsis oppositifolia* are sometimes abundant on less saline portions of the alliance.

This alliance occurs in depressions and river valleys. The loam to sandy loam soils are deep, poorly drained and formed in alluvium (Steinauer 1989). These soils are slightly to strongly affected by soluble salt. Standing water is at or near the surface for most of the year.

Environment: Plant associations within this alliance occur in saline meadows, depressions, playas, and river valleys in the western United States. Elevations range from 750-1380 m. Sites are located in wet areas such as along smaller streams and the edges of marshes, ponds, and playas (Hansen et al. 1995, Bundy et al. 1996, Jones and Walford 1995, Walford 1996). Although these sites are often subjected to inundation (up to 1.5 m) in the early season, they are generally free of standing water by midsummer. Groundwater levels are often at or near ground surface (Brotherson and Barnes 1984). Soils are typically Entisols or Mollisols. Soil texture ranges from clay loam to sandy loam, and the soils are commonly poorly drained. Soil reaction is typically alkaline (pH 8.5) (Steinauer 1989, Hansen et al. 1995).

Adjacent wetter communities are usually dominated by *Eleocharis palustris*. *Typha latifolia* or *Schoenoplectus acutus* can dominate the open water. In Nevada, adjacent communities are dominated by *Sarcobatus vermiculatus*.

Vegetation: Plant associations within this alliance are classified as semipermanently flooded temperate or subpolar grasslands. *Schoenoplectus pungens* (= *Scirpus pungens*) dominates the graminoid layer, forming dense stands. Other common herbaceous associates include *Suaeda calceoliformis*, *Spartina pectinata*, *Muhlenbergia asperifolia*, *Distichlis spicata*, and *Ruppia maritima*. *Chenopodium incanum*, *Monolepis nuttalliana*, and *Picradeniopsis oppositifolia* are sometimes abundant on less saline portions of the alliance. In eastern Wyoming, *Hordeum jubatum* and *Hordeum jubatum* ssp. *intermedium* (= *Hordeum caespitosum*) are present in most stands in small amounts (Jones and Walford 1995).

Dynamics: Hansen et al. (1995) state that *Schoenoplectus pungens* is an early colonizer of suitable habitats and able to persist under wet conditions. It is tolerant of alkaline conditions, but does not require it (Cronquist et al. 1977). Because of the wet soil conditions and aggressive growth of *Schoenoplectus pungens*, other species can be precluded from the sites. Disturbance can cause the establishment of increaser species such as *Juncus balticus* and *Hordeum jubatum*. Lowering the water table may dry the site and result in a decrease of *Schoenoplectus pungens*. An increase in salinity may increase alkaline-tolerant species.

Comments: This alliance is found mostly in the western United States and needs rangewide review. There are taxonomic issues between *Schoenoplectus americanus* and *Schoenoplectus pungens* that need to be understood before the concept of this alliance is clear.

ALLIANCE SOURCES

Authors: D. CULVER, West **Identifier:** A.1433

References: Brotherson and Barnes 1984, Bundy et al. 1996, Cronquist et al. 1977, Faber-Langendoen et al. 1996, Hansen et al. 1991, Hansen et al. 1995, Jones and Walford 1995, Kittel and Lederer 1993, Kittel et al. 1994, Kittel et al. 1999a, Lesica 1989, Steinauer 1989, Walford 1996

SCHOENOPLECTUS PUNGENS HERBACEOUS VEGETATION Threesquare Herbaceous Vegetation

ELEMENT CONCEPT

Summary: This bulrush wet meadow community is found in the western United States in the intermountain basins, as well as in western parts of the Great Plains. Stands are found along low-gradient, meandering, usually perennial streams and around the margins of ponds and marshes. *Schoenoplectus pungens* (= *Scirpus pungens*) dominates the dense, 0.3- to 0.6-m tall herbaceous vegetation layer. Other species that often are present include *Schoenoplectus maritimus* (= *Scirpus maritimus*), *Spartina gracilis*, *Hordeum jubatum*, *Pascopyrum smithii*, *Juncus balticus*, *Eleocharis palustris*, *Lemna minor*, *Sagittaria latifolia*, and *Typha* spp. Stands of this association contain no tree or shrub layer, but a few scattered trees and shrubs may be present, most commonly *Populus deltoides*, *Salix amygdaloides*, *Salix exigua*, *Symphoricarpos occidentalis*, or *Sarcobatus vermiculatus*. Substrates are generally dark, organic, fine-textured soils derived from alluvium.

Environment: Stands of this widespread association are found throughout much of the western U.S. in appropriate wetland habitat. Elevations range from 1000-2400 m. Stands occur along low-gradient, meandering, usually perennial streams, around the margins of ponds and marshes, in low-lying swales, and abandoned or overflow channels where the soils remain saturated. (Hansen et al. 1995, Kittel et al. 1999, Jones and Walford 1995, Walford 1996). It also occurs on silt and sand bars within the active channel. Soils are generally derived from alluvium and are fine-textured, black, alkaline, organic anoxic with gleying. Soils range from normal to saline with pH ranging from 7.4-9.1.

Vegetation: This widespread wetland association is characterized by a dense, 0.3- to 0.6-m tall herbaceous vegetation layer that is dominated by *Schoenoplectus pungens* (= *Scirpus pungens*). Associated species include *Schoenoplectus maritimus* (= *Scirpus maritimus*), *Spartina gracilis*, *Hordeum jubatum*, *Pascopyrum smithii*, *Juncus balticus*, *Eleocharis palustris*, *Lemna minor*, *Sagittaria latifolia*, and *Typha* spp. Stands of this association contain no tree or shrub layer, but a few scattered trees and shrubs may be present, most commonly *Populus deltoides*, *Salix amygdaloides*, *Salix exigua*, *Symphoricarpos occidentalis*, or *Sarcobatus vermiculatus*.

Dynamics: Stands of this association are flooded in the spring (Larson 1993).

Similar Associations:

- *Schoenoplectus americanus* Western Herbaceous Vegetation (CEGL001841)--stands are dominated by *Schoenoplectus americanus* instead of *Schoenoplectus pungens*.
- *Spartina pectinata* - *Schoenoplectus pungens* Herbaceous Vegetation (CEGL001478)--should probably be split into a *Spartina* type and a *Schoenoplectus pungens* type.

GRank & Reasons: G3G4 (98-04-09).

Comments: Muldavin et al. (2000a) described 5 *Schoenoplectus pungens* (= *Scirpus pungens*) community types from New Mexico. Most are codominated with an associated species listed in the vegetation description, e.g., *Eleocharis palustris*, *Distichlis spicata*, *Paspalum distichum*, and *Equisetum laevigatum*, with one being a *Schoenoplectus pungens* Monotype Community Type reported from the Gila River basin. Muldavin et al.'s (2000a) concept of this community type states that it can be dominated by *Schoenoplectus pungens* (= *Scirpus pungens*) or *Schoenoplectus americanus* (= *Scirpus americanus*, = *Scirpus olneyi*). Hansen et al. (1995) also include *Schoenoplectus americanus* in their *Scirpus pungens* Habitat Type. This association needs further review to clarify whether to include stands where *Schoenoplectus pungens* is not the dominant species.

ELEMENT DISTRIBUTION

Range: This community is found in the western United States in the intermountain basins, as well as in western parts of the Great Plains, from Montana south to Colorado, and west into Nevada, Utah, and Wyoming.

Nations: US

States/Provinces: CO:S3, KS:S?, MT:S3, ND:S?, NM:S?, NV:S?, SD:S?, UT:S2S4, WY:S?

ELEMENT SOURCES

Authors: G.P. Jones, mod. K. Schulz, WCS **Confidence:** 2 **Identifier:** CEGL001587

References: Bourgeron and Engelking 1994, Brotherson and Barnes 1984, Bundy et al. 1996, Driscoll et al. 1984, Gleason and Cronquist 1991, Great Plains Flora Association 1986, Hansen et al. 1991, Hansen et al. 1995, Jones and Walford 1995, Kittel and Lederer 1993, Kittel et al. 1994, Kittel et al. 1999a, Larson 1993, Lauver et al. 1999, MTNHP 1988, Muldavin et al. 2000a, Walford 1996

**TYPHA (ANGUSTIFOLIA, LATIFOLIA) - (SCHOENOPLECTUS SPP.)
SEMIPERMANENTLY FLOODED HERBACEOUS ALLIANCE**(Narrowleaf Cattail, Broadleaf
Cattail) - (Clubbrush species) Semipermanently Flooded Herbaceous Alliance

ALLIANCE CONCEPT

Summary: This alliance, found in virtually every state in the United States and probably most Canadian provinces, contains stands dominated by *Typha angustifolia* and/or *Typha latifolia*, either alone or in combination with other tall emergent marsh species. Associated species vary widely; in the Midwest they include many sedges such as *Carex aquatilis*, *Carex rostrata*, *Carex pellita* (= *Carex lanuginosa*), bulrushes such as *Schoenoplectus americanus* (= *Scirpus americanus*), *Schoenoplectus acutus* (= *Scirpus acutus*), and *Schoenoplectus heterochaetus* (= *Scirpus heterochaetus*), and broad-leaved herbs such as *Thelypteris palustris*, *Asclepias incarnata*, *Impatiens capensis*, *Sagittaria latifolia*, *Scutellaria lateriflora*, *Sparganium eurycarpum*, *Hibiscus moscheutos*, and *Verbena hastata*. Floating aquatics such as *Lemna minor* may predominate in deeper zones.

This alliance is found most commonly along lake margins and in shallow basins, and occasionally in river backwaters. Lacustrine cattail marshes typically have a muck-bottom zone bordering the shoreline, where cattails are rooted in the bottom substrate, and a floating mat zone, where the roots grow suspended in a buoyant peaty mat. *Typha angustifolia* can grow in deeper water compared to *Typha latifolia*, although both species reach maximum growth at a water depth of 50 cm. *Typha* often occurs in pure stands, and can colonize areas recently exposed by either natural or human causes. *Lythrum salicaria*, an exotic species from Europe, has become a common associate of many eastern *Typha* marshes. In the Southeast, this alliance is widespread and currently representative of a wide variety of mixed marshes with no clear dominants. Vegetation in this alliance may be natural or semi-natural and includes mixed stands of the nominal species, as well as essentially monospecific stands of *Typha latifolia*. These monospecific stands occur especially in artificial wetlands, such as borrow pits or ponds. This alliance occurs on hydric soils in wetlands, ditches, ponds, lakes, and rivers, as well as on shorelines and streambanks. Inundation is commonly 3-6 dm (1-2 feet) in depth. These marshes have hydric soils and are flooded with water levels ranging from several centimeters to more than 1 m for a significant part of the growing season. Occurrences may display areas of open water, but emergent vegetation dominates (80% cover). Seasonal flooding during winter and spring or flooding during heavy rains help maintain these marshes by causing water exchange which replenishes freshwater and circulates nutrients and organic debris. Soils which support this community can be mineral or organic but are saturated, flooded, or ponded long enough during the growing season to develop anaerobic conditions in the upper part. Vegetative diversity and density is highly variable in response to water depth, water chemistry, and natural forces.

Environment: This alliance is found most commonly along lake or pond margins, slow-moving ditches, in shallow basins, adjacent to stream or river channels in wet mud, oxbows, and occasionally in river backwaters. Elevations range from near sea level to around 2000 m in Colorado. Sites where this alliance occurs are typically semipermanently flooded, inundated with 30-100 cm of water throughout the year. Lacustrine cattail marshes typically have a muck-bottom zone bordering the shoreline, where cattails are rooted in the bottom substrate, and a floating mat zone, where the roots grow suspended in a buoyant peaty mat. *Typha angustifolia* can grow in deeper water compared to *Typha latifolia*, although both species reach maximum growth at a water depth of 50 cm (Grace and Wetzel 1981). Soils are characterized by accumulations of organic matter over deposits of fine silt and clay (Hansen et al. 1995), or loams, sandy loams, or coarse sand (Jones and Walford 1995, Bundy et al. 1996). *Typha* often occurs in pure stands, and can colonize areas recently exposed by either natural or human causes.

Adjacent herbaceous wetland vegetation types can be dominated by species of *Scirpus* and/or *Schoenoplectus*, *Carex*, or *Eleocharis*. Riparian shrublands or forests include those dominated by species of *Salix*, *Fraxinus*, or *Populus*. **Vegetation:** This alliance, is found at low to moderate elevations in virtually every state in the United States and probably most Canadian provinces. It contains stands dominated by *Typha angustifolia* and/or *Typha latifolia*, either alone or in combination with other tall emergent marsh species. Associated species vary widely; in the central and western United States, they include many sedges such as *Carex aquatilis*, *Carex rostrata*, *Carex pellita* (= *Carex lanuginosa*), and bulrushes such as *Schoenoplectus americanus* (= *Scirpus americanus*), *Schoenoplectus acutus* (= *Scirpus acutus*), *Schoenoplectus tabernaemontani* (= *Scirpus tabernaemontani*), and *Schoenoplectus heterochaetus* (= *Scirpus heterochaetus*). Other graminoids can include *Juncus* spp., *Eleocharis* spp., or *Glyceria* spp. In the central and eastern parts of its range, broad-leaved herbs such as *Thelypteris palustris*, *Asclepias incarnata*, *Impatiens capensis*, *Sagittaria latifolia*, *Scutellaria lateriflora*, *Sparganium eurycarpum*, *Hibiscus moscheutos*, and *Verbena hastata*, may be present. In the west, forbs may include *Mentha arvensis*, *Polygonum amphibium*, *Epilobium ciliatum* and many others. Floating aquatics such as *Lemna minor* may predominate in deeper zones (Anderson 1982, MNNHP 1993, Hansen et al. 1995).

Dynamics: *Typha angustifolia* occupies inundated and disturbed grounds and can tolerate deeper water and higher alkalinity levels than *Typha latifolia* (Great Plains Flora Association 1986). *Typha* species are prolific seed producers, spreading rapidly to become the early colonizers of wet mineral soil and will persist under wet conditions (Hansen et al. 1995). Roots and lower stems are well-adapted to prolonged submergence, but periods of draw-down are required for seed germination to

occur (Hansen et al. 1995). These are important wetland communities for many species of birds and waterfowl. Hansen et al. (1995) report that in Montana heavy livestock use may convert stands to *Carex nebrascensis*-dominated communities.

Comments: It has been suggested that mixed emergent marshes tend to occur on harder pond, lake, or river bottoms and are less likely to contain a peaty mat with its diverse mixture of forbs (MNNHP 1993). Alliances that describe marshes dominated by mixed emergents other than cattails and the associates listed above include the V.A.5.N.1 *Phragmites australis* Semipermanently Flooded Herbaceous Alliance (A.1431), the V.A.5.N.1 *Schoenoplectus acutus* - (*Schoenoplectus tabernaemontani*) Semipermanently Flooded Herbaceous Alliance (A.1443), the V.A.5.N.1 *Schoenoplectus americanus* Semipermanently Flooded Herbaceous Alliance (A.1432), and the V.A.5.N.1 *Zizania (aquatica, palustris)* Semipermanently Flooded Herbaceous Alliance (A.1441). In shallow flooded conditions this alliance grades into the V.A.5.N.k *Typha* spp. - (*Schoenoplectus* spp., *Juncus* spp.) Seasonally Flooded Herbaceous Alliance (A.1394), as well as V.A.5.N.k *Schoenoplectus fluviatilis* Seasonally Flooded Herbaceous Alliance (A.1387). *Typha latifolia* can hybridize with *Typha angustifolia*, and the hybrid, *Typha X glauca*, may be more invasive of disturbed areas than the parent species. In the West, some studies have classified marshes dominated by *Typha domingensis* as phases of *Typha latifolia* marshes. This alliance now includes wetland communities dominated by *Typha latifolia*, often in disturbed or sedimented situations. The concept and distribution of this alliance in the Southeast needs reassessment. Many of the presettlement occurrences of this alliance have been drained and converted to cropland or destroyed by siltation, which greatly accelerates the natural successional process from shallow inundation to moist soil. *Lythrum salicaria* is an aggressive exotic species that threatens this vegetation type in Canada, the Northeast, and more recently in the Midwest.

ALLIANCE SOURCES

Authors: MCS, MOD. M.S. REID, MP, Midwest **Identifier:** A.1436

References: Anderson 1982, Apfelbaum 1985, Bundy et al. 1996, Bunin 1985, Christy 1973, Eggers and Reed 1987, Faber-Langendoen et al. 1996, Fike 1999, Foti 1994b, Foti et al. 1994, Grace and Wetzel 1981, Great Plains Flora Association 1986, Hansen et al. 1991, Hansen et al. 1995, Hoagland 1998a, Hoagland 2000, Jones and Walford 1995, Kittel et al. 1996, Kittel et al. 1999a, Komarkova 1976, Komarkova 1986, Kovalchik 1993, Lindauer 1978, Lindauer and Christy 1972, MNNHP 1993, Masek 1979, McEachern 1979, Mitsch and Gosselink 1993, Mohlenbrock 1959, Muldavin et al. 1993b, Muldavin et al. 2000a, Padgett et al. 1989, Sawyer and Keeler-Wolf 1995, Segadas-Vianna 1951, Simkins 1931, Smith 1991, TNC 1995b, Tolstead 1942, Wharton 1978, Youngblood et al. 1985a

TYPHA LATIFOLIA WESTERN HERBACEOUS VEGETATION Broadleaf Cattail Western Herbaceous Vegetation

ELEMENT CONCEPT

Summary: This association is widespread across the western United States and western Great Plains occurring near streams, rivers, and ponds. The soil is flooded or saturated for at least part of the growing season. The dominant species, *Typha latifolia*, often forms dense, almost monotypic stands. *Carex* spp. and *Schoenoplectus* spp. (= *Scirpus* spp.) are often found in this community, especially on the margins.

Environment: This widespread community is found along streams, rivers, canals, and the banks of ponds and lakes. Elevations range from near sea level to 2000 m. Sites are nearly level. The soil is saturated or flooded for much of the year from freshwater sources such as springs or streams. The alluvial soils have variable textures ranging from sand to clay and usually with a high organic content.

Vegetation: This community is dominated by hydrophytic macrophytes, especially *Typha latifolia*, which grow from approximately 2-3 m tall. *Typha latifolia* often forms dense, near-monotypic stands (70-98% cover), almost to the exclusion of other species. Other species typical of wetlands may be found in lesser amounts in this community; among these are shallower water emergents such as *Carex* spp., *Eleocharis macrostachya*, *Eleocharis palustris*, *Glyceria* spp., *Juncus balticus*, *Juncus torreyi*, *Mentha arvensis*, *Schoenoplectus acutus*, and *Veronica* spp. In deeper water, *Lemna minor*, *Potamogeton* spp., *Sagittaria* spp., *Azolla filiculoides*, and other aquatics may be present in trace amounts. Trace amounts of grasses like *Agrostis stolonifera*, *Beckmannia syzigachne*, *Hordeum jubatum*, *Muhlenbergia asperifolia*, and *Phalaris arundinacea* may also be present.

Dynamics: This association is dependent on flooding and high water tables from flowing freshwater sources, such as streams and seeps, and does not grow well in alkaline or stagnant water (Von Loh 2000). Disturbance greatly increases the total number of species present (Hansen et al. 1995). *Typha* spp. produce abundant wind-dispersed seeds that allow them to colonize wet bare soil sites quickly and to survive under wet conditions (Muldavin et al. 1999, Hansen et al. 1995).

Similar Associations:

- *Schoenoplectus acutus* - *Typha latifolia* - (*Schoenoplectus tabernaemontani*) Sandhills Herbaceous Vegetation (CEGL002030)--occurs in Great Plains, but is codominated by *Schoenoplectus* spp.
- *Typha (angustifolia, domingensis, latifolia)* - *Schoenoplectus americanus* Herbaceous Vegetation (CEGL002032)--occurs in Great Plains, but is codominated by *Schoenoplectus* spp.
- *Typha latifolia* - *Equisetum hyemale* - *Carex (hystericina, pellita)* Seep Herbaceous Vegetation (CEGL002033)--occurs in Great Plains, but is codominated by *Equisetum* and *Schoenoplectus* spp.

- *Typha latifolia* Southern Herbaceous Vegetation (CEGL004150)--occurs in the southern Great Plains and is very similar, but has not been reported further west than Arkansas, Oklahoma and Texas; further review is need to clarify differences.

GRank & Reasons: G5 (94-02-23).

Comments: This community is a common element found in many wetland systems, but has received little attention. Consequently, the diagnostic features and species of this community are not well known. Some ecologists (Hansen et al. 1995, Kittel et al. 1999) have include *Typha angustifolia* as a codominant in this association. More classification work is needed to clarify the concept of this association.

ELEMENT DISTRIBUTION

Range: *Typha latifolia* Herbaceous Vegetation is widely distributed, occurring across the western United States and western Great Plains.

Nations: CA US

States/Provinces: AZ:S3, BC:S5, CA:S3, CO:S3, ID:S4, MT:S5, NM:S5, NV:S?, OR:S5, UT:S2S4, WA:S5, WY:S?

ELEMENT SOURCES

Authors: J. Drake, mod. K. Schulz, WCS **Confidence:** 2 **Identifier:** CEGL002010

References: Baker 1984a, Bourgeron and Engelking 1994, Bundy et al. 1996, Bunin 1985, Christy 1973, Crowe and Clausnitzer 1997, Dethier 1990, Driscoll et al. 1984, Hansen et al. 1991, Hansen et al. 1995, Holland 1986b, Johnston 1987, Jones and Walford 1995, Kittel et al. 1996, Kittel et al. 1999a, Kovalchik 1993, Kunze 1994, Lindauer 1978, Lindauer and Christy 1972, Masek 1979, McEachern 1979, Muldavin et al. 1993b, Padgett et al. 1989, Ramaley 1939b, Titus et al. 1996, Tolstead 1942, Von Loh 2000, Youngblood et al. 1985a

CAREX SIMULATA SATURATED HERBACEOUS ALLIANCE Analogue Sedge Saturated Herbaceous Alliance

ALLIANCE CONCEPT

Summary: Vegetation types within this saturated, temperate or subpolar grassland alliance occur in wet meadows from the foothills to moderate elevations in the mountains. Elevations range from 1350 m in eastern Oregon to 2700 m in Wyoming. Stands occur in wet basins on gentle slopes below seeps and on flat alluvial terraces adjacent to streams. Surface topography is usually smooth to slightly undulating. Soils are typically Histosols with organic matter accumulations 30-120 cm thick, but may be poorly drained, fine-textured mineral soils as well. Redox depletions or reduced matrices are common throughout the profile. Water tables remain at or near the soil surface during the growing season. Soils are slightly acidic to neutral (pH 6.0-7.0). The soils often quake when walked on due to cold, mucky, groundwater flowing just below the surface. *Carex simulata* dominates the graminoid stratum with 30-80% cover. Other graminoid species include *Carex aquatilis*, *Carex utriculata*, *Deschampsia caespitosa*, and *Juncus balticus*. Forb cover is sparse and includes *Pedicularis groenlandica* and *Triglochin maritima*. Shrub species are uncommon, typically forming less than 5% cover. Shrub species include *Betula nana* (= *Betula glandulosa*), *Salix wolfii*, and *Salix planifolia*. The moss layer may be dense with up to 90% cover. Adjacent vegetation includes *Schoenoplectus acutus* (= *Scirpus acutus*) on wetter sites and *Carex utriculata* and *Dasiphora fruticosa* ssp. *floribunda* (= *Pentaphylloides floribunda*) on drier sites.

Environment: Vegetation types within this alliance occur in wet meadows from the foothills to moderate elevations in the mountains. Elevations range from 1350 m in eastern Oregon to 2700 m in Wyoming. Stands occur in wet basins on gentle slopes below seeps and on flat alluvial terraces adjacent to streams. Surface topography is usually smooth to slightly undulating.

Soils are typically Histosols with organic matter accumulations 30-120 cm thick, but may be poorly drained, fine-textured mineral soils as well. Redox depletions or reduced matrices are common throughout the profile. Water tables remain at or near the soil surface during the growing season. Soils are slightly acidic to neutral (pH 6.0-7.0) (Hansen et al. 1995). Kovalchik (1987) reports that the soils often quake when walked on due to cold, mucky, groundwater flowing just below the surface.

Adjacent vegetation includes *Schoenoplectus acutus* on wetter sites and *Carex utriculata* and *Dasiphora fruticosa* ssp. *floribunda* on drier sites.

Vegetation: Vegetation types within this alliance are classified as saturated, temperate or subpolar grasslands. *Carex simulata* dominates the graminoid stratum with 30-80% cover. Other graminoid species include *Carex aquatilis*, *Carex utriculata*, *Deschampsia caespitosa*, and *Juncus balticus* (Hansen et al. 1988, Hansen et al. 1995). Forb cover is sparse and includes *Pedicularis groenlandica* and *Triglochin maritima*. Shrub species are uncommon, typically forming less than 5% cover. Shrub species include *Betula nana* (= *Betula glandulosa*), *Salix wolfii*, and *Salix planifolia*. Kovalchik (1987) states that the moss layer may be dense with up to 90% cover.

Dynamics: Hansen et al. (1988) state that *Carex simulata* types are relatively stable. Minor fluctuations in water levels do not change species composition (Youngblood et al. 1985).

ALLIANCE SOURCES

Authors: D. CULVER, West **Identifier:** A.1469

References: Cronquist et al. 1977, Hansen et al. 1988b, Hansen et al. 1991, Hansen et al. 1995, Hermann 1970, Johnston 1987, Kovalchik 1987, Martin and Hutchins 1980, Nachlinger 1985, Padgett et al. 1988b, Padgett et al. 1989, Sanderson and Kettler 1996, Tuhy and Jensen 1982, Youngblood et al. 1985a

SARCOBATUS VERMICULATUS SHRUB HERBACEOUS ALLIANCEBlack Greasewood Shrub Herbaceous Alliance

ALLIANCE CONCEPT

Summary: This alliance is locally restricted in the northern Great Plains to saline sites. It is dominated by herbaceous species, but the presence of shrubs sets it apart from similar types found on saline soil. Total vegetation cover is open to moderate, with bare soil common. *Distichlis spicata* and *Puccinellia nuttalliana* dominate the herbaceous layer, accompanied by *Symphotrichum ericoides* (= *Aster ericoides*), *Grindelia squarrosa*, *Hordeum jubatum*, *Pascopyrum smithii*, *Plantago* spp., and *Salicornia rubra* (on more saline inclusions). *Sarcobatus vermiculatus*, *Artemisia frigida*, and *Artemisia tridentata* form a sparse shrub layer only rarely exceeding 25%.

This alliance is found on terraces, floodplains, swales and other low sites where drainage is poor. The soils are moderately to strongly saline, fine-textured, and moderately deep to deep. Although periodic flooding is rare, stands of this alliance receive more water than the surrounding uplands through runoff.

Environment: This alliance is found on terraces, floodplains, swales and other low sites where drainage is poor. The soils are moderately to strongly saline, fine-textured, and moderately deep to deep (USFS 1992). Although periodic flooding is rare, stands of this alliance receive more water than the surrounding uplands through runoff.

Vegetation: This alliance is locally restricted in the northern Great Plains to saline sites. It is dominated by herbaceous species but the presence of shrubs sets it apart from similar types found on saline soil. Total vegetation cover is open to moderate with bare soil common. *Distichlis spicata* and *Puccinellia nuttalliana* dominate the herbaceous layer, accompanied by *Symphotrichum ericoides* (= *Aster ericoides*), *Grindelia squarrosa*, *Hordeum jubatum*, *Pascopyrum smithii*, *Plantago* spp., and *Salicornia rubra* (on more saline inclusions). *Sarcobatus vermiculatus*, *Artemisia frigida*, and *Artemisia tridentata* form a sparse shrub layer only rarely exceeding 25%.

ALLIANCE SOURCES

Authors: MCS, Midwest **Identifier:** A.1535

References: Faber-Langendoen et al. 1996, USFS 1992

SARCOBATUS VERMICULATUS / DISTICHLIS SPICATA - (PUCCINELLIA NUTTALLIANA) SHRUB HERBACEOUS VEGETATIONBlack Greasewood / Saltgrass - (Nuttall's Alkali Grass) Shrub Herbaceous Vegetation

ELEMENT CONCEPT

Summary: This greasewood saline shrub prairie type is found in the northern Great Plains of the United States and Canada. Stands occur on somewhat saline soils, and salt crusts may occur. The vegetation contains scattered medium-tall (0.5-1 m) shrubs with a cover of 10-25%. The shrub layer is dominated by *Sarcobatus vermiculatus*. Herbaceous species include *Distichlis spicata* and *Puccinellia nuttalliana*.

Environment: Stands occur on somewhat saline soils, and salt crusts may occur.

Vegetation: The vegetation contains scattered medium-tall (0.5-1 m) shrubs with a cover of 10-25%. The shrub layer is dominated by *Sarcobatus vermiculatus*. Herbaceous species include *Distichlis spicata* and *Puccinellia nuttalliana*.

Similar Associations:

- *Sarcobatus vermiculatus* / *Pascopyrum smithii* - (*Elymus lanceolatus*) Shrub Herbaceous Vegetation (CEGL001508)

GRank & Reasons: G? (96-10-03).

Comments: This type closely resembles *Sarcobatus vermiculatus* / *Pascopyrum smithii* - (*Elymus lanceolatus*) Shrub Herbaceous Vegetation (CEGL001508). Nebraska applies that type to stands that may fit this type.

ELEMENT DISTRIBUTION

Range: This greasewood saline shrub prairie type is found in the northern Great Plains of the United States and Canada, extending from the Dakotas into Saskatchewan.

Nations: CA? US

States/Provinces: ND:S3S4, SD:SU, SK?

ELEMENT SOURCES

Authors: ?, mod. D. Faber-Langendoen, MCS **Confidence:** 2 **Identifier:** CEGL002146

References: Thilenius et al. 1995

TRIGLOCHIN MARITIMA SEMIPERMANENTLY FLOODED HERBACEOUS ALLIANCE

Seaside Arrow-grass Semipermanently Flooded Herbaceous Alliance

ALLIANCE CONCEPT

Summary: This semipermanently flooded alliance has been described from high-elevation intermountain parks in Colorado. Stands occur in lowland habitats such as saline marshes, salt flats, and at calcareous springs in extreme rich fens. These habitats are flooded throughout the growing season in most years. The water table may drop below the surface at the end of the growing season or during drought years, but the soils will still be saturated which permits the development of organic peat. Soils are poorly drained, deep, saline and alkaline, often derived from calcareous marls or limestone. Vegetation included in this alliance is characterized by an herbaceous layer that is dominated by the perennial rhizomatous forb *Triglochin maritima*. Other common species include *Carex microglochin*, *Eleocharis quinqueflora*, *Puccinellia nuttalliana*, *Salicornia rubra*, *Ranunculus cymbalaria*, *Schoenoplectus americanus* (= *Scirpus americanus*), and *Symphyotrichum ciliatum* (= *Aster brachyactis*). Cover and species composition is controlled largely by salinity, which is regulated by the amount of water dilution. *Triglochin maritima* and *Salicornia rubra* were more abundant in saline areas, and the salt-tolerant *Distichlis spicata* was restricted to the more saline sites. Generally, vegetation height, cover, and species diversity tend to vary inversely with salinity. Diagnostic of the wetland herbaceous alliance is the dominance of *Triglochin maritima*.

Environment: Vegetation in this semipermanently flooded alliance has been described from high-elevation intermountain parks in Colorado. Stands occur in lowland habitats such as saline marshes, salt flats, and at calcareous springs in extreme rich fens. These habitats are flooded throughout the growing season in most years. The water table may drop below the surface at the end of the growing season or during drought years, but the soils will still be saturated which permits the development of organic peat. Ungar (1974) described 'wet' and 'dry' *Triglochin maritima* communities. The drier sites had higher total salts 2.1% vs. 1.6%. Both sites had a median pH of 8.1. Salinity is largely controlled by the amount of water dilution. Cooper (1996) described a community in water track microhabitats within expansive peatland fens in South Park, Colorado. Climate is temperate and semi-arid. At South Park, Colorado (elevation approximately 2900 m), mean annual precipitation is 27 cm with 75% occurring during the growing season (Ungar 1974). Sites are nearly level saline marshes and salt flats. These soils are poorly drained, deep, saline and alkaline often derived from calcareous marls or limestone. In the northern Great Plains, similar *Triglochin maritima*-dominated stands described by Dodd and Coupland (1966) had coarse-textured (fine sand to sandy clay), saline, gleyed soils. More classification work needed to determine if these stands should be included in the same alliance.

Adjacent vegetation is generally controlled by salinity. On a large scale stands may be arranged in concentric circles according to the salt tolerance of the dominant species. *Salicornia rubra* stands (a more salt-tolerant species) would be in the center with *Puccinellia nuttalliana* stands forming on the less saline side. On a smaller scale the ground surface often has hollows, water tracks or hummocks which often have less salt-tolerant species occurring on them (Ungar 1974, Cooper 1996).

Vegetation: The semipermanently flooded vegetation included in this is herbaceous alliance has been described from saline wetlands in a high elevation intermountain park in Colorado. Cover is sparse to moderately dense and is controlled largely by salinity which is regulated by the amount of water dilution. Stands are largely dominated by the perennial rhizomatous forb *Triglochin maritima*. Other common species include *Carex microglochin*, *Eleocharis quinqueflora*, *Puccinellia nuttalliana*, *Salicornia rubra*, *Ranunculus cymbalaria*, *Schoenoplectus americanus* (= *Scirpus americanus*), and *Symphyotrichum ciliatum* (= *Aster brachyactis*). The more salt-tolerant species, *Triglochin maritima* and *Salicornia rubra* were more abundant on the 'dry' type. The salt-tolerant *Distichlis spicata* was found only in the 'dry' type. Generally, vegetation height and cover, and species diversity tend to vary inversely with salinity (Ungar 1967, Steinauer 1989).

Dynamics: The flooding regime combined with high evaporation rate in these dry climates and the mineral-rich spring water causes accumulations of soluble salts in the soil. Total vegetation cover (density and height), species composition and soil salinity depend on the amount and timing of precipitation and flooding. Growth-inhibiting salt concentrations are diluted when the soil is saturated. This allows the growth of less salt-tolerant species and more robust growth of tolerant species. As the saturated soils dry, the salt concentrates until it precipitates out on the soil surface (Dodd and Coupland 1966, Ungar 1968). Vegetation forms zones at some saline sites, where species abundance is stratified by salt tolerance (Shupe et al. 1986, Ungar et al. 1969). In playas, the soil salinity at field capacity generally increases from the edge to the center allowing for several different vegetation stands to co-occur (Ungar 1967, 1970, Ungar et al. 1969). Microtopography can also affect vegetation structure. Where soil accumulates to form hummocks, less salt- and alkali-tolerant plants can occur (Ungar 1972).

Comments: *Triglochin maritima*-dominated wetlands have been described from saline marshes in Saskatchewan, Canada. These stands are very similar to those included in this alliance from Colorado. More information is needed to determine if these stands should be included in this alliance.

ALLIANCE SOURCES

Authors: K. SCHULZ, West **Identifier:** A.1681

References: Cooper 1996, Cooper n.d., Dodd and Coupland 1966, Sanderson and Kettler 1996, Sanderson and March 1996, Shupe et al. 1986, Steinauer 1989, Ungar 1967, Ungar 1968, Ungar 1970, Ungar 1972, Ungar 1974c, Ungar et al. 1969

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